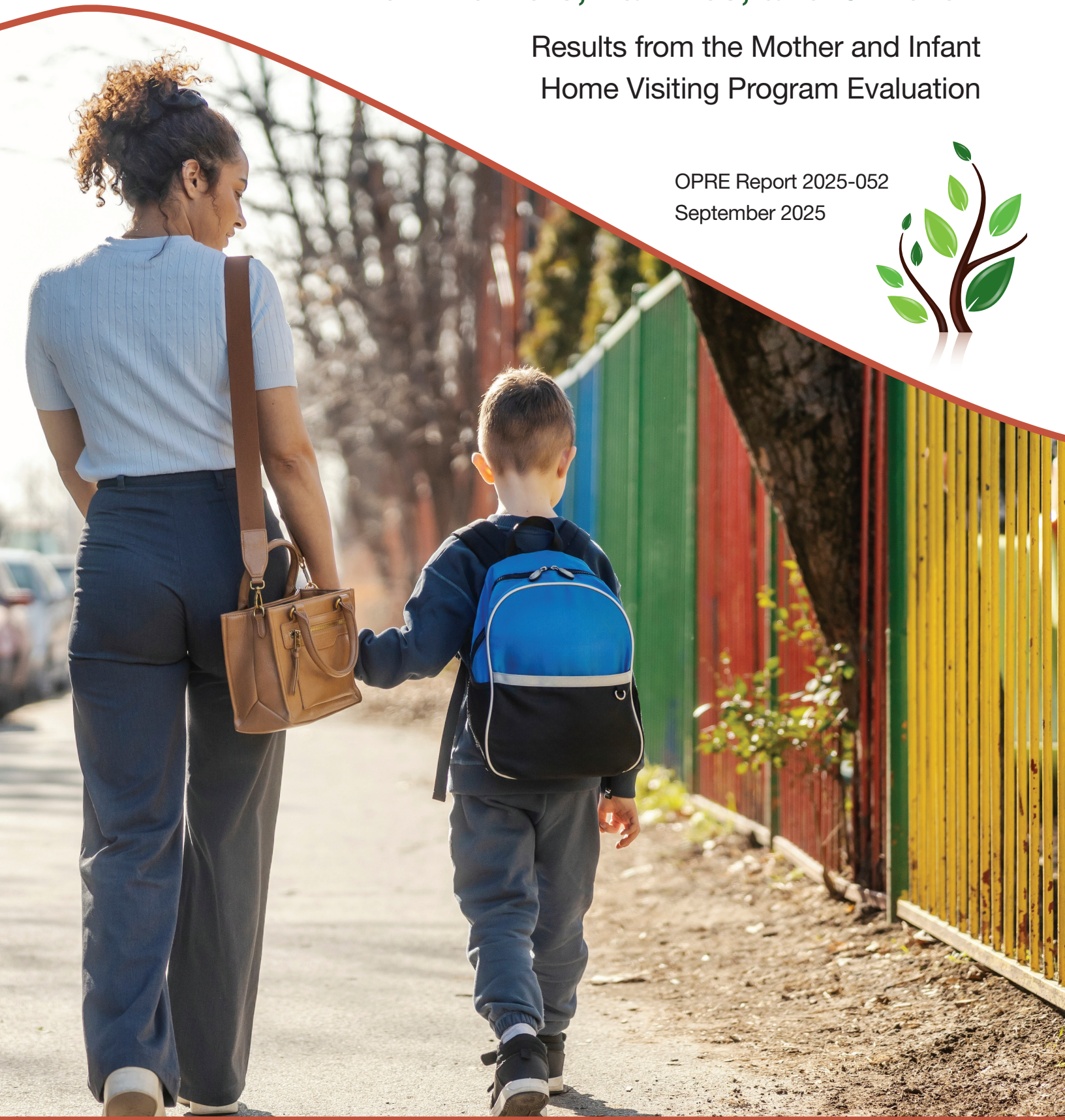


BEYOND THE EARLY YEARS

The Long-Term Effects of Home Visiting on Mothers, Families, and Children

Results from the Mother and Infant
Home Visiting Program Evaluation

OPRE Report 2025-052
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Beyond the Early Years

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OVERVIEW

The overarching goal of the Mother and Infant Home Visiting Program Evaluation (MIHOPE) is to provide information about whether families and children benefit from Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program-funded early childhood home visiting programs as they operated from 2012 to 2017 in the early years of the program's inception, and if so, how. The MIECHV Program is administered by the Health Resources and Services Administration (HRSA) in collaboration with the Administration for Children and Families (ACF).

Women enrolled in the MIHOPE randomized controlled trial when they were pregnant or had a child younger than 6 months of age. To date, the MIHOPE study team has reported on the effects of home visiting programs around the time the children were 15 months, 2.5 years, and 3.5 years of age. To examine the potential long-term effects of the MIECHV Program on children and families, MIHOPE included a follow-up when children were in kindergarten (approximately five to six years after women enrolled in the study). Though designed as a kindergarten follow-up, the COVID-19 pandemic caused data collection to pause during the 2020-2021 school year, which meant that data were collected when some children in the study were in first grade.

Because home visiting programs address a broad range of outcomes related to maternal, family, and child well-being, impacts were estimated on 66 outcomes. This report examines the effectiveness of home visiting across groups of outcomes organized into eight pre-specified topical research questions, using omnibus tests to look beyond effects on individual outcomes.

MIHOPE found statistically significant and positive effects of home visiting for the five research questions that measured maternal and family well-being outcomes. The results of omnibus tests indicate that home visiting had favorable effects on outcomes more readily impacted by direct interactions or services provided by home visitors. These include (1) maternal coping strategies and parenting behaviors that could be improved through direct interaction between parents and home visitors; (2) maternal mental and behavioral health; (3) parent-child interactions; (4) a constellation of outcomes related to conflict, violence, aggression, and maltreatment; and (5) families' economic circumstances.

MIHOPE found some evidence of positive effects of home visiting for the three research questions related to child functioning outcomes. The result of the omnibus test for children's social-emotional functioning in the home context was statistically significant and positive. A similar pattern of effects emerged on outcomes related to children's social-emotional functioning in school settings, but the omnibus test result was not statistically significant, potentially due to the smaller sample of teachers who reported on these measures. The omnibus test result was also not statistically significant for the research question related to children's cognitive, language, and math skills.

The kindergarten follow-up demonstrates the potential value of using groups of outcomes to interpret and understand effects across the many areas of family functioning that home visiting programs address. Using this analytical method, the study found favorable effects of home visiting on six of the research questions, indicating that MIECHV-funded home visiting programs resulted in improvements for families five to seven years after study enrollment in outcome areas cited in the MIECHV authorizing legislation.

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This report is the culmination of the joint effort of a large team who contributed to the MIHOPE kindergarten follow-up design, data collection, and analysis. At MDRC, Leslyn Hall provided data collection oversight, Matthew MacFarlane facilitated fielding of the COVID-19 focused web survey, Marissa Strassberger led the COVID-19 qualitative data collection and analysis, directing the work of Osvaldo Avila, Helen Lee, Emily Marano, Victoria Quiroz-Becerra, Rebecca Schwartz, Sophia Sutcliffe, Mallory Undestad, Samantha Wulfsohn, and Jennifer Yeaton; Livia Martinez contributed to processing and analyzing the kindergarten data obtained from administrative sources and direct data collection, as well as many other technical staff throughout the years of data acquisition, collection, processing, and analysis, including Desiree Alderson, Sally Dai, Victor Porcelli, Miki Shih, Anne Warren, and Samantha Xia. Alex Giles provided excellent assistance with many aspects of the report, including with foundational literature reviews. Chuck Michalopoulos provided expert guidance about methodological issues.

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The Authors

1

MIHOPE Introduction

Early childhood home visiting programs provide individually tailored support, resources, and information to expectant parents and families with young children. Many programs aim to support the healthy development of infants and toddlers to help ensure their well-being.

Home visiting programs in the United States have their origins in the late nineteenth century, when charitable organizations used home visiting to try to reduce poverty by changing the behavior of families who were then characterized as “the urban poor.”¹ Home visiting later expanded to include approaches such as visits by public health nurses to promote infant and child health, Head Start home visiting to promote child development, and home-based family support to promote positive parenting and prevent child maltreatment.²

In current practice, home visitors work with families to help identify family strengths, needs, concerns, and interests and attempt to address those in partnership with families through education and support during home visits or through referrals to and coordination with community services. The goals of home visiting programs are broad. Evidence-based models have goals that range from enhancing the development of very young children and cultivating and strengthening nurturing parent-child relationships to promoting school readiness and improving families’ economic self-sufficiency and maternal life course.³

In 2010, Congress authorized the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program by enacting section 511 of the Social Security Act, 42 U.S.C. § 711, which also appropriated funding for fiscal years 2010 through 2014.⁴ Subsequently enacted

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1. Weiss (1993).
 2. Combs-Orme, Reis, and Ward (1985); Harding et al. (2007); Love et al. (2005).
 3. Duggan et al. (2018).
 4. SEC. 511 [42 U.S.C. 711] (j) (1).

laws extended funding for the program through fiscal year 2027.⁵ The program is administered by the Health Resources and Services Administration (HRSA) in collaboration with the Administration for Children and Families (ACF) within the U.S. Department of Health and Human Services (HHS).⁶ The initiation of the MIECHV Program began a major expansion of evidence-based home visiting programs for families living in communities that states identified as “at-risk” of poor maternal and child health outcomes.⁷

The legislation that authorized the MIECHV Program required awardees’ early childhood home visiting programs to work toward demonstrating improvements in several benchmark areas.⁸ The six current MIECHV benchmark areas are: improved maternal and newborn health; prevention of child injuries, child abuse, neglect, or maltreatment, and reduction of emergency department visits; improvement in school readiness and achievement; reduction in crime or domestic violence; improvements in family economic self-sufficiency; and improvements in the coordination and referrals for other community resources and supports. By law, awardees must demonstrate improvement for eligible families participating in the program in at least four of the six benchmark areas.⁹

The legislation authorizing MIECHV recognized that there was considerable evidence about the effectiveness of home visiting, but also called for research to increase knowledge about the implementation and effectiveness of home visiting.¹⁰ States that receive MIECHV funding are required to devote the majority of their MIECHV funding to deliver services using evidence-based models that meet HHS’s criteria for evidence of effectiveness. At the same time, states can spend up to a quarter of their MIECHV funding on promising approaches to achieving improvements in benchmark areas as long as well-designed and rigorous evaluations of those promising approaches are conducted.¹¹ The authorizing legislation also required an evaluation of MIECHV in its early years, which became the Mother and Infant

5. Funds for subsequent fiscal years were appropriated by section 209 of the Protecting Access to Medicare Act of 2014, Pub. L. 113-93 (fiscal year 2015); section 218 of the Medicare Access and Children’s Health Insurance Program Reauthorization Act of 2015, Pub. L. 114-10 (fiscal years 2016-2017); section 50601 of the Bipartisan Budget Act of 2018, Pub. L. (fiscal years 2018-2022); and section 6101 of the Consolidated Appropriations Act, 2023, Pub. L. 117-328 (fiscal years 2023-2027).

6. HRSA distributes funds from the federal MIECHV Program to MIECHV state and territory awardees. In 2024, HRSA provided awards to 56 states and territories, including 47 state agencies; 3 nonprofit organizations serving Florida, North Dakota, and South Carolina; the District of Columbia; and 5 U.S. territories. Awardees distribute funds to local implementing agencies—also commonly referred to as local programs—that work directly with families. Additionally, ACF oversees the Tribal MIECHV Program, which in 2024 funded 47 federally recognized Indian tribes (or consortium of Indian tribes), tribal organizations, and urban Indian organizations across 21 states.

7. SEC. 511 [42 U.S.C. 711] (b).

8. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi).

9. SEC. 511 [42 U.S.C. 711] (h) (3) (A), as amended by section 6101 of the Consolidated Appropriations Act, 2023 (P.L. 117-328).

10. SEC. 511 [42 U.S.C. 711] (h) (3) (A).

11. SEC. 511 [42 U.S.C. 711] (h) (3) (A), as amended by section 6101 of the Consolidated Appropriations Act, 2023 (P.L. 117-328).

Home Visiting Program Evaluation (MIHOPE).¹² The overarching goal of MIHOPE is to provide information about whether families and children benefit from MIECHV-funded early childhood home visiting programs as they operated from 2012 to 2017, and if so, how.

Given that previous long-term studies of home visiting found positive effects, ACF and HRSA initiated plans in 2016 to design long-term follow-ups with the families who enrolled in MIHOPE to examine the potential long-term effects, including cost benefits, of the MIECHV Program on children and families.¹³ The purpose of this design phase was to determine the most fruitful times to collect data to answer questions of interest in the context of a study that follows families over time.¹⁴

A follow-up data collection when children were in kindergarten, approximately five to six years after their mothers enrolled in MIHOPE, was selected because measuring children's cognitive, behavioral, self-regulatory, and social-emotional skills at the outset of formal schooling could provide important data on the intermediate effects of home visiting. In addition, a wealth of literature demonstrates that children's language, social-emotional, and math skills at the transition to formal schooling are predictive of academic and behavioral outcomes in the longer term.¹⁵ Consistent with this evidence from the literature, the legislation that authorized MIECHV indicated that MIECHV-funded home visiting programs are expected to improve school readiness; this was not something that could be measured during previous MIHOPE follow-ups.¹⁶ Additionally, a follow-up in the children's kindergarten year allowed the study team to measure outcomes that could be mediators in order to examine the mechanisms or processes by which home visiting may predict longer term outcomes.

This report presents results from the study team's analysis of the MIHOPE kindergarten follow-up data.

The study team planned to conduct the kindergarten follow-up during the four school years in which children in the sample were slated to attend kindergarten: 2018-2019 (Cohort 1), 2019-2020 (Cohort 2), 2020-2021 (Cohort 3), and 2021-2022 (Cohort 4). However, the COVID-19 pandemic affected the planned data collection for Cohorts 3 and 4. Kindergarten data collection paused during the 2020-2021 school year and resumed during the 2021-2022 school year, when children in Cohort 3 were slated to attend first grade and Cohort 4 were slated to attend kindergarten. In light of the ongoing pandemic at the time, the study team adapted the kindergarten data collection to conduct all in-home assessments virtually

12. SEC. 511 [42 U.S.C. 711] (g) (2).

13. See Michalopoulos, Faucetta, Warren, and Mitchell (2017).

14. For more information, see Faucetta et al. (2020).

15. Duncan et al. (2007); Eisenberg, Valiente, and Eggum (2010); Portilla et al. (2014).

16. SEC. 511 [42 U.S.C. 711] (c) (1) indicates that grants are to be made to enable eligible entities to deliver home visiting services in order to promote improvement in several outcome areas that include school readiness. SEC. 511 [42 U.S.C. 711] (d) (1) (A) includes school readiness in the list of benchmark areas that eligible entities are expected to improve.

for Cohorts 3 and 4. The study team also implemented additional data collection efforts (a survey and qualitative interviews conducted virtually in 2020-2021) to enhance understanding of how families in MIHOPE were experiencing the pandemic, to contextualize the study's kindergarten findings.

The remainder of this chapter introduces:

- The MIHOPE design
- Home visiting activities and the home visiting models included in MIHOPE
- The families in the MIHOPE sample
- Effects found in earlier waves of MIHOPE
- Evidence from earlier studies of the four models included in MIHOPE
- The contents of this report

THE MIHOPE DESIGN

MIHOPE is a randomized controlled trial. That is, to provide reliable estimates of home visiting programs' effects, women who enrolled in the study were randomly assigned either to a MIEHCV-funded local home visiting program (the “program group”), or to receive information about other appropriate services in the community (the “control group”).

MIHOPE includes 88 local home visiting programs in 12 states (California, Georgia, Illinois, Iowa, Kansas, Michigan, Nevada, New Jersey, Pennsylvania, South Carolina, Washington, and Wisconsin). The study includes the four evidence-based models that 10 or more states chose in their initial MIECHV plans in fiscal year 2010-2011: Early Head Start—Home-based option, Healthy Families America, Nurse-Family Partnership, and Parents as Teachers. When local programs were recruited for MIHOPE, 19 were implementing the Early Head Start—Home-based option, 26 were implementing Healthy Families America, 22 were implementing Nurse-Family Partnership, and 21 were implementing the Parents as Teachers model.¹⁷

HOME VISITING ACTIVITIES AND THE HOME VISITING MODELS INCLUDED IN MIHOPE

In general, home visiting consists of three types of activities:

17. For information about state and site selection, see Michalopoulos et al. (2019).

- **Assessing family needs.** To identify family strengths, needs, concerns, and interests, home visitors gather information from families through formal screening and assessment and through informal means that include reading cues provided by family members.
- **Educating and supporting parents.** Having identified family needs, home visitors devote most of their time to providing education and support to families. For example, home visitors share information with families on topics such as children’s developmental stages and provide feedback to support parenting. Home visitors can also provide support during crises such as threats of being evicted or incidents of family violence. In addition, home visitors work to strengthen families’ support networks. Home visitors use methods such as positive reinforcement, direct suggestions and encouragement, role playing, and motivational interviewing to support healthy behavior and positive parenting.
- **Referral and coordination.** For some family needs, home visitors may think the family will benefit from receiving more specialized services in the community. In MIHOPE, referrals were most commonly made to address breastfeeding and nutrition, economic self-sufficiency, and public assistance or health insurance. This aspect of home visiting highlights the place of home visiting as one component in a comprehensive system of care for early childhood.¹⁸

Although all four evidence-based models included in MIHOPE conduct these activities and share the overall goal of improving outcomes for at-risk families and their young children, they differ in several important ways. Table 1.1 summarizes some important features of the four evidence-based models as they existed when MIHOPE began.

Program goals. While all four models aimed to improve child health and development in the broad sense, their specific goals differed. For example, Early Head Start provided comprehensive services that focused on the development of infants and toddlers, supporting parents in their roles as caregivers and teachers of their children, and promoting school readiness. In addition to the goals of strengthening nurturing parent-child relationships, promoting healthy childhood growth and development, and enhancing family functioning, Healthy Families America emphasized preventing child maltreatment. Nurse-Family Partnership strongly emphasized the social determinants of health, improving birth outcomes through preventive health practices, and improving child health and development. It also aimed to improve mothers’ economic self-sufficiency and development. Parents as Teachers focused on supporting families to enhance parents’ knowledge of early childhood development, improve parenting practices, detect early signs of developmental delays and health issues, and promote children’s school readiness and success.

Intended recipients and timing of enrollment. Most of these models served families they identified as being at risk of poor child outcomes, based on one or more family characteristics. Although the indicators used to identify families at risk differed among the models,

18. Duggan et al. (2018).

Table 1.1. Planned Services of the Evidence-Based Home Visiting Models in MIHOPE: Goals, Recipients, Enrollment, and Duration

Component	Early Head Start–Home-Based Option	Healthy Families America	Nurse-Family Partnership	Parents as Teachers
Evidence-based model goals ^a	<p>Enhance the development of very young children</p> <p>Promote healthy family functioning</p> <p>Promote school readiness</p>	<p>Build and sustain community partnerships to systematically engage overburdened parents in home visiting services prenatally or at birth</p> <p>Cultivate and strengthen nurturing parent-child relationships</p> <p>Promote healthy childhood growth and development</p> <p>Enhance family functioning by reducing risk and building protective factors</p> <p>Prevent child maltreatment and adverse experiences</p>	<p>Improve prenatal health and birth outcomes</p> <p>Improve child health and development</p> <p>Improve families’ economic self-sufficiency and maternal life course development</p>	<p>Provide parents with child development knowledge and parenting support</p> <p>Provide early detection of developmental delays and health issues</p> <p>Prevent child maltreatment</p> <p>Increase school readiness</p>
Intended recipients	<p>Low-income pregnant women and families with children from birth to 3 years of age, families at or below the federal poverty level, and children with disabilities who are eligible for Part C services under the Individuals with Disabilities Education Act in their states</p>	<p>Parents facing challenges such as single parenthood, low incomes, childhood histories of abuse or adverse experiences, current or past behavioral health issues, or domestic violence</p> <p>Local programs select the specific characteristics of the target populations they plan to serve</p>	<p>First-time, low-income, pregnant mothers and their children</p>	<p>No eligibility requirements for participants</p> <p>Local programs select the specific characteristics of their target populations, such as children with special needs, families at risk for child abuse, low-income families, teen parents, first-time parents, immigrant families, families with low literacy, or parents with mental health or substance use issues</p>
Intended timing of enrollment	<p>Pregnancy through age 3</p>	<p>Pregnancy or within the first 3 months after a child’s birth</p>	<p>Before the end of the 28th week of pregnancy^b</p>	<p>Pregnancy or soon after birth, though can continue until age 5</p>

(continued)

Table 1.1 (continued)

Component	Early Head Start–Home-Based Option	Healthy Families America	Nurse-Family Partnership	Parents as Teachers
Intended duration of enrollment	Through the child’s third birthday ^c	Through the child’s third birthday but can extend to child’s fifth birthday	Through the child’s second birthday	Local programs required to offer at least two years of services to families; recommend offering three years of services; services can be offered until kindergarten entry

SOURCES: Evidence-based model websites (EHS: <https://headstart.gov/program-planning/home-visitors-online-handbook/requirements-home-based-option>; HFA: www.healthyfamiliesamerica.org; NFP: www.nursefamilypartnership.org; PAT: parentsasteachers.org), the U.S. Department of Health and Human Services Home Visiting Evidence of Effectiveness (HomVEE) website (homvee.acf.gov/), and MIHOPE evidence-based model developer interviews.

NOTES: EHS = Early Head Start–Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers. The information in this table was obtained when the MIHOPE study began.

^aGoals are as stated by each evidence-based model.

^bLocal programs are recommended to begin conducting visits as early as possible in the pregnancy.

^cChildren can remain with EHS until they transition into other appropriate settings.

most models tried to enroll families with low incomes. Nurse-Family Partnership specifically tried to enroll women early in their first pregnancies, while Healthy Families America tried to enroll families during any pregnancy or shortly after birth who faced a variety of risk factors for child maltreatment or other negative childhood experiences (risk factors such as histories of trauma or intimate partner violence, behavioral health issues, and single parenthood). Parents as Teachers has historically served a broad array of families with children in its target age range.¹⁹

Program intensity and duration. The four evidence-based models also varied somewhat in the frequency of their home visits. Early Head Start offered weekly home visits, while Healthy Families America and Nurse-Family Partnership offered weekly visits during critical periods (for example, shortly after birth) and Parents as Teachers specified monthly, biweekly, or weekly visits depending on families' needs (not shown in Table 1.1). The four models also differed in their intended duration of enrollment: Early Head Start offered services through the child's third birthday; Healthy Families America offered services through the child's third birthday but services can extend to the child's fifth birthday; Nurse-Family Partnership offered services through the child's second birthday; and for Parents as Teachers, local programs are required to offer at least two years of services to families, but Parents as Teachers recommends offering three years of services, and services can be offered until kindergarten entry. Although services are offered for these periods of time, families may not participate in home visiting services for as long as the models intend.

THE FAMILIES IN THE MIHOPE SAMPLE

A total of 4,229 families entered the study from October 2012 to October 2015. To be eligible for MIHOPE, women had to be at least 15 years of age, be either pregnant or have a child younger than 6 months of age when they enrolled in the study, speak English or Spanish well enough to provide consent and complete a survey when they entered the study, and be interested in receiving home visiting services. They also could not already be receiving home visiting services from a participating local program and had to meet the relevant local program eligibility criteria.

Women participating in MIHOPE tended to be young, and they were experiencing a variety of risks at study entry that could affect their children's development.²⁰ Specifically, almost 66 percent of the women were younger than 25 years of age, and 35 percent were younger than 21 years of age. Forty-two percent of the women in the sample did not have a high

19. All models could enroll women who met the MIHOPE eligibility criteria, although Early Head Start and Parents as Teachers accepted families whose youngest children were up to 3 years old and through kindergarten entry, respectively. In other words, Early Head Start and Parents as Teachers enrolled a much broader range of families than are included in MIHOPE, which includes only families with children under 6 months old at enrollment.

20. Duncan and Brooks-Gunn (2000); Aber, Bennett, Conley, and Li (1997); Eamon (2001); Glover (2011); Mulder et al. (2002); Van den Bergh and Marcoen (2004); Davis et al. (2004).

school diploma. More than 50 percent of the women reported that their households had experienced food insecurity in the past year (meaning there were times when they worried about food or ran out of it). Nearly 75 percent of women in the sample were receiving benefits from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and more than 50 percent were enrolled in the Supplemental Nutrition Assistance Program (SNAP). Nearly 33 percent reported substance use before pregnancy, over 40 percent reported symptoms of either depression or anxiety, and about 20 percent reported experiencing or perpetrating physical acts of intimate partner violence.²¹

EARLIER MIHOPE FOLLOW-UPS

Prior to the kindergarten follow-up, the MIHOPE follow-up data collection points included one extensive follow-up, timed to occur when children in the study sample were approximately 15 months of age, and two brief check-ins with families, timed to occur when children were approximately 2.5 and 3.5 years of age.

The first MIHOPE follow-up occurred between May 2014 and June 2017, around the time the study child was 15 months of age.²² The study team first estimated the effects of MIECHV-funded early childhood home visiting programs on family and child outcomes through an extensive assessment of all but one of the outcome areas that the legislation that authorized the MIECHV Program indicated the program should affect, including: (1) prenatal, maternal, and newborn health; (2) child health and development, including child maltreatment; (3) parenting skills; (4) crime or domestic violence; (5) family economic self-sufficiency; and (6) referrals and service coordination.²³

The study team found that MIECHV-funded home visiting programs had positive effects for families when children were 15 months of age, and most estimated effects were similar to but somewhat smaller than the average found in past studies of individual home visiting models. Specifically, estimated effects were statistically significant for 4 of the 12 confirmatory outcomes: the quality of the home environment, the frequency of psychological aggression toward the child, the number of Medicaid-paid child emergency department visits,

21. Substance use before pregnancy includes having seven or more drinks in a week (heavy drinking), consuming four or more drinks in one sitting at least once (binge drinking), or using drugs illicitly (either by using illegal drugs—including marijuana—or by misusing prescriptions). For more information, see Michalopoulos et al. (2019).

22. Michalopoulos et al. (2019) describes the results of the impact analysis and analysis of impact variation from the first phase of MIHOPE.

23. SEC. 511 [42 U.S.C. 711] (d) (2) (B). The legislation also indicated that programs should improve school readiness and academic achievement, but children in MIHOPE were too young to provide information about that area at the follow-up that occurred when they were 15 months of age.

and child behavior problems.²⁴ Overall, for 9 of the 12 confirmatory outcomes, program group families fared better than control group families on average, which was unlikely to have occurred for the study sample if the home visiting programs made no true difference in family outcomes. Results for several exploratory outcomes suggested home visiting may improve maternal health and that home visiting might also reduce household aggression.²⁵

The next MIHOPE follow-ups occurred when children were about 2.5 and 3.5 years of age.²⁶ Although the primary purpose of these follow-ups was to check in with families and obtain updated contact information, all families were also asked to complete 30-minute surveys that included a limited set of questions about six outcome areas: (1) maternal health; (2) child health; (3) family economic self-sufficiency; (4) discipline practices and strategies; (5) parental support for cognitive development; and (6) child functioning. Since the survey was short, the study team could only measure a limited set of parent-reported outcomes, could not comprehensively assess any of the outcome areas examined, and could not assess all the outcome areas specified in the legislation authorizing MIECHV. Of the six confirmatory outcomes examined at each time point, only one estimated effect was statistically significant, suggesting that home visiting did not have effects on these particular outcomes as measured through parent report. However, an analysis of all outcomes (both confirmatory and exploratory) in each outcome area indicated positive effects in the areas of parental support for cognitive development and child functioning.²⁷

EVIDENCE OF EFFECTIVENESS FROM PRIOR STUDIES OF THE FOUR HOME VISITING MODELS INCLUDED IN MIHOPE

Studies of each of the four early childhood home visiting models included in MIHOPE (Early Head Start—Home-based option, Healthy Families America, Nurse-Family Partnership, and Parents as Teachers) have examined the longitudinal effects of home visiting programs, including around the time children are approximately five to seven years of age.²⁸

24. To focus the 15-month analysis on areas where home visiting programs were likely to have their greatest short-term effects, the study team chose 12 outcomes as confirmatory. Outcomes were designated as confirmatory based on prior evidence of positive effects on that outcome, the policy relevance of the outcome, and the quality of the tools available to measure those outcomes.

25. Outcomes were designated as exploratory when past home visiting studies had not found effects or they had not been examined in previous studies. For more information, see Michalopoulos et al. (2019).

26. Faucetta, Michalopoulos, Portilla, and Saunders (2023).

27. Faucetta, Michalopoulos, Portilla, and Saunders (2023).

28. The MIHOPE study team has previously presented evidence of effectiveness from the four home visiting models included in MIHOPE from follow-ups that occurred when children were 5 to 21 years of age in Faucetta et al. (2020) and Michalopoulos et al. (2017). As described in Faucetta et al. (2020), in designing the kindergarten follow-up, the study team focused on evidence from follow-ups that occurred around the time children were 5 to 6 years of age.

To provide some context for the motivation for the MIHOPE kindergarten follow-up, which can build on or confirm evidence from previous studies, Figure 1.1 presents evidence from five previous model-specific studies that conducted follow-ups around this time point (one study of Early Head Start, one study of Healthy Families America, two studies of Nurse-Family Partnership, and one study of Parents as Teachers).²⁹ In looking to the evidence of home visiting's effectiveness from these studies, it is important to note that these studies occurred many years ago (most of the studies began enrolling families before 1995, and most follow-ups occurred before 2005), and home visiting programs have continued to evolve over time—in part in response to the MIECHV Program—as has the service environment available to families who are not in home visiting programs. Figure 1.1 is organized by the outcome areas included in the legislation that authorized MIECHV.³⁰

As Figure 1.1 shows, previous model-specific studies appear to have focused on examining the effectiveness of home visiting in improving measures of child development and school performance (79 examinations), which account for about half of total examinations of the effectiveness of home visiting around these ages. Child development and school performance is the only area examined by studies of all four models. About 24 percent of outcomes in this area are statistically significant and positive, which is more than would be expected if home visiting had no effect on these outcomes. This indicates that home visiting is effective in improving measures of child development and school performance.³¹

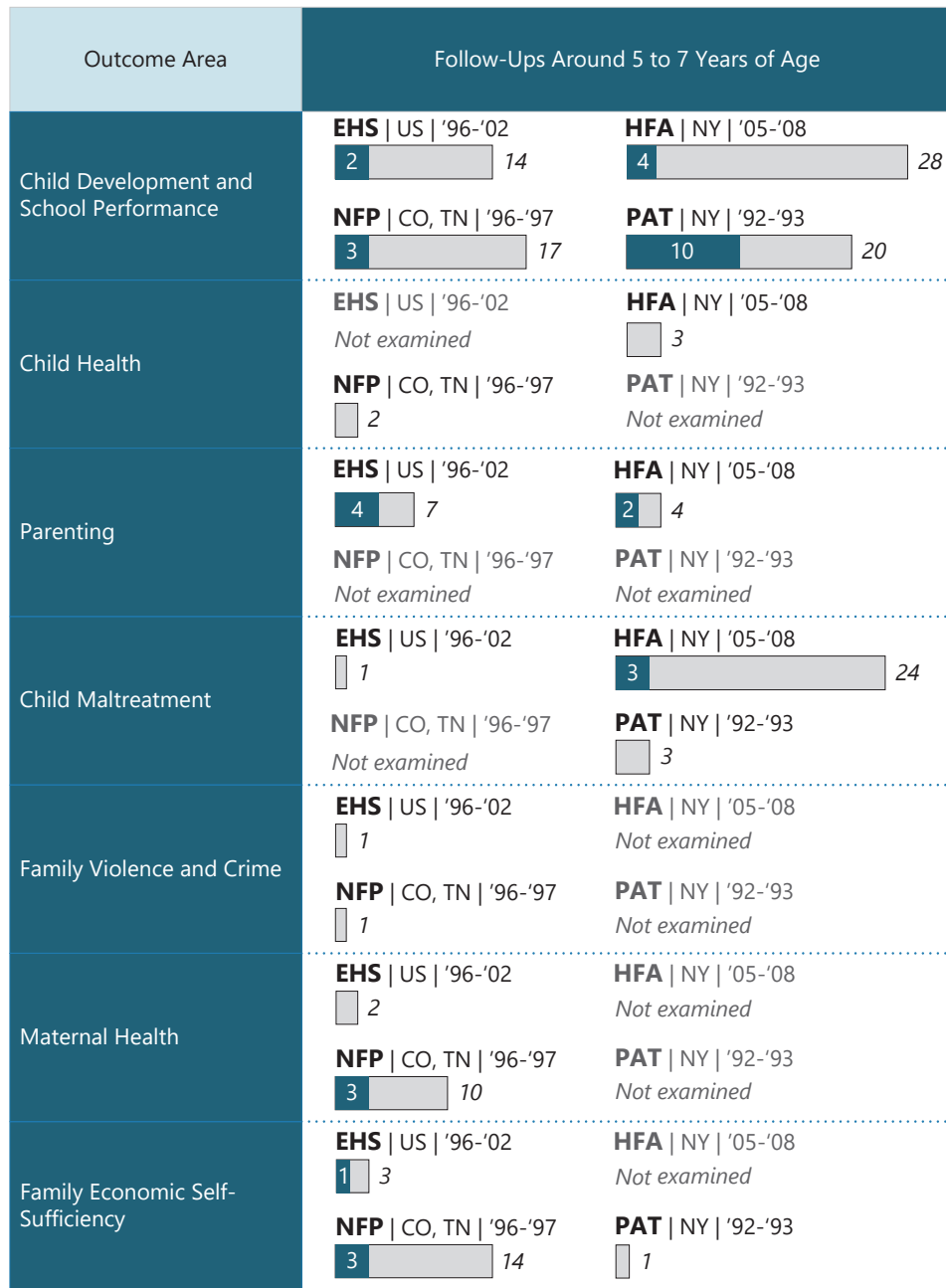
There have been some examinations of home visiting's ability to improve outcomes related to child maltreatment, family economic self-sufficiency, maternal health, and parenting (ranging from 11 to 28 examinations per outcome area), but because these areas have not been examined as often as child development, and none have been examined in studies of all four models, it is difficult to draw conclusions about the overall ability of home visiting to affect outcomes in these areas around this age based on prior studies. It is even more difficult to draw conclusions about the ability of home visiting to affect outcomes related to child health and to family violence and crime, as prior studies have reported only five examinations of effects on child health outcomes and two examinations of effects on family violence and crime outcomes.

29. The studies included in Figure 1.1 and described in this chapter are those that are listed on the Home Visiting Evidence of Effectiveness (HomVEE) website (<http://homevee.acf.gov>) as being of either high quality or moderate quality and included children that are approximately 5 to 7 years of age. Drazen and Haust (1993) had a prekindergarten follow-up that included some children who were 4 years of age and some children who were 5 years of age, so it is included here. However, any studies that looked only at children 4 years of age and younger were excluded. All but one of the studies, the Parents as Teachers study, was a randomized controlled trial. Baseline sample sizes of the five studies range from 40 to 1,385.

30. The authorizing legislation refers to Juvenile Delinquency, Family Violence, and Crime, but Figure 1.1 refers to Family Violence and Crime due to the timing of the follow-ups presented.

31. In this case, estimates are considered statistically significant if there is less than a 5 percent likelihood that the effect is due to chance based on a two-tailed t-test (that is, assuming effects have the possibility of appearing in a positive or negative direction). Across this set of findings, about 5 percent of the findings (about 4 examinations) would be statistically significant at the 5 percent significance level even if home visiting had no benefits for families in this area.

Figure 1.1. Evidence of Effects from Previous Model-Specific Home Visiting Studies (Follow-Ups Around 5 to 7 Years of Age)



NOTES: The blue bars indicate the number of statistically significant outcome examinations. The gray bars indicate the total number of outcome examinations.

EHS=Early Head Start—Home-based option, kindergarten follow-up. HFA=Healthy Families America, first grade follow-up. NFP=Nurse-Family Partnership, CO follow-up at 6 years of age, TN follow-up at 6 years of age. PAT= Parents as Teachers, follow-up at 4 to 5 years of age.

The MIHOPE kindergarten analysis provides information about home visiting's ability to affect outcomes in all these outcome areas, with the exception of child health.³²

CONTENTS OF THIS REPORT

This report focuses on addressing the question:

What are the effects of home visiting programs on maternal, family, and child outcomes when children were in kindergarten or first grade?

Chapter 2 describes the design of the kindergarten follow-up and the analytic strategy used to examine the effects of home visiting. The analytic strategy is applied in Chapter 3 to answer eight topical research questions that frame the discussion of whether home visiting programs had favorable effects for families:

- Did home visiting affect outcomes that could be improved through direct interaction between parents and home visitors?
- Did home visiting affect maternal mental and behavioral health?
- Did home visiting affect parent-child interactions?
- Did home visiting affect conflict, violence, aggression, and maltreatment?
- Did home visiting affect families' economic circumstances?
- Did home visiting affect children's social-emotional functioning in the home context?
- Did home visiting affect children's social-emotional functioning in school settings?
- Did home visiting affect children's cognitive, language, and early math skills?

Chapter 4 describes how the COVID-19 pandemic interrupted the kindergarten data collection effort and how the data collection effort was adapted to continue assessing the longer-term effects of home visiting at the time the focal children transitioned to formal schooling, as well as to understand how MIHOPE families were faring during the pandemic, to be able to contextualize kindergarten findings. To do this, the chapter presents findings on families' experiences during two time periods: late 2020 through early 2021 and the 2021-2022 school year. It also includes the study's investigation into whether the timing of data collection affected the overall patterns of effects seen in Chapter 3.

32. Child health was not prioritized in the MIHOPE kindergarten design. This decision was made following consultation with federal staff and expert advisers. For more information, please see Appendix D of Faucetta et al. (2020).

Appendices to the report include the results of exploratory analyses conducted to understand whether the effects of home visiting are larger for some families than others, based on (1) subgroups defined by families' demographic characteristics and psychosocial risk factors such as educational attainment and adverse childhood experiences; and (2) the four evidence-based home visiting models included in MIHOPE. An additional appendix includes an exploratory examination of the mechanisms through which home visiting had effects on select individual outcomes at the kindergarten follow-up using mediators measured at earlier waves of MIHOPE.

2

MIHOPE Kindergarten Follow-Up: Design and Analytic Strategy

As described in Chapter 1, follow-up data collection when children in the MIHOPE sample were in kindergarten was planned because measuring children’s cognitive, behavioral, self-regulatory, and social-emotional skills at the outset of formal schooling could provide important data on the longer-term effects of home visiting. This chapter describes the kindergarten follow-up’s design and data sources, as originally planned, and the adaptations made amidst the COVID-19 pandemic to preserve the study’s ability to examine the effects of home visiting on families and their children when they transitioned to formal schooling, including changes to the timing of data collection. The chapter concludes by describing the analytic strategy used to examine the effects on families and children at this key developmental period in children’s lives.

KINDERGARTEN FOLLOW-UP DATA SOURCES

The kindergarten follow-up presented an opportunity to examine the effects of home visiting on a broad set of outcome areas by conducting a more extensive data collection effort at this time point than had been possible at the 2.5- and 3.5-year check-ins. Those check-ins only involved administering brief surveys with caregivers, providing a snapshot of how families were faring at those time points.

For the current report, information on child and family outcomes comes from the following data sources:¹

1. Two additional data sources collected information about families’ experiences during the COVID-19 pandemic and are described in Chapter 4.

Caregiver survey

- A structured interview with the children’s mothers to measure a broad set of constructs that are mostly not available from other data sources²

Direct assessments³

- Direct assessments of children’s language, math, and executive functioning skills conducted by trained field interviewers
- Observations of parental warmth and children’s self-regulation conducted by trained field interviewers during the direct assessment
- Observations of mother-child interactions, such as parental sensitivity and child engagement of parent, by trained independent observers during a video-recorded semi-structured play interaction

Teacher survey

- A teacher survey to measure children’s social and emotional development, approaches to learning, disciplinary incidents, receipt of special services, and school attendance

Administrative records

- Federal administrative data on healthcare use via Medicaid
- Federal administrative data on employment covered by the unemployment insurance system (National Directory of New Hires)
- State administrative child welfare records
- School records, from state and local education agencies

Table 2.1 features the kindergarten follow-up sample sizes by data source.

2. In cases where the mother was not available (for example, because she no longer had custody of the child), data collection was conducted with the child’s primary caregiver, such as the child’s father. This approach was also used at the MIHOPE follow-up that occurred when children were 15 months of age.

3. Trained interviewers also completed a direct assessment of mothers’ working memory. That data was not used in this kindergarten analysis.

Table 2.1. MIHOPE Kindergarten Sample Sizes by Data Source

Data Source	Sample
Structured interview with the children's mothers	2,442
Direct assessments	2,332
Teacher survey	1,317
Federal administrative data on healthcare use via Medicaid (mothers)	3,053
Federal administrative data on healthcare use via Medicaid (children)	2,295
Federal administrative data on employment (National Directory of New Hires)	3,416
State child welfare records	2,692
School records	1,041
Sample size (total = 4,102)	

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, direct assessments, teacher survey, Medicaid enrollment records, National Directory of New Hires records, state administrative child welfare records, and school records.

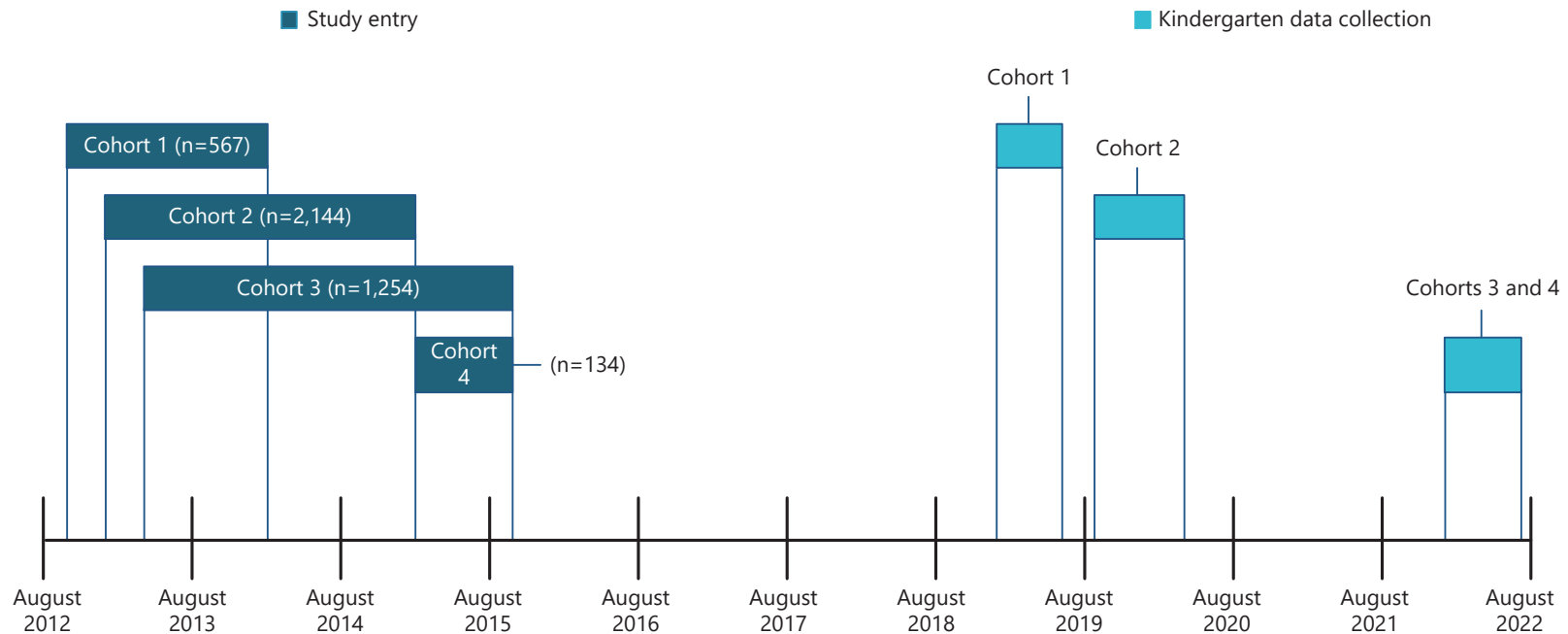
TIMING OF KINDERGARTEN DATA COLLECTION

Initially, the kindergarten follow-up was designed to occur approximately five to six years after women enrolled in MIHOPE, to capture children's transition into formal schooling. Because random assignment of families into the study occurred from October 2012 to October 2015, the children in the MIHOPE sample were expected to attend kindergarten over four school years. In this report, the sample of children who were expected to attend kindergarten in each year is referred to as a cohort. Cohort 1 children were expected to attend kindergarten in the 2018-2019 school year, Cohort 2 in the 2019-2020 school year, Cohort 3 in the 2020-2021 school year, and Cohort 4 in the 2021-2022 school year.

Figure 2.1 shows the fielded sample sizes for each data collection cohort.⁴ The kindergarten data collection for Cohort 1 was fielded from January 2019 to June 2019.⁵ Data collection for Cohort 2 was fielded from September 2019 to April 2020.⁶

4. A total of 4,229 women were randomly assigned in MIHOPE. Over the course of MIHOPE, 21 families withdrew from the study, two sample members from a small local program were removed from the analysis, one sample member was found to have a child who was too old for the study, and 103 women miscarried the focal child, resulting in a final analysis sample of 4,102 families (2,041 in the program group and 2,061 in the control group). During fielding, if a child was deemed ineligible for data collection because the child was not yet in kindergarten, fielding was attempted during the next cohort. Three children were deemed ineligible during fielding of Cohorts 3 and 4. Given there was no subsequent cohort, these three families are excluded from the fielded sample. The total kindergarten fielded sample is 4,099.
5. The study team originally planned on fielding Cohort 1 beginning in fall 2018, but data collection began in January 2019 due to logistical issues.
6. Data collection with teachers continued after March 2020 since surveys were completed via the web or mailed paper surveys.

Figure 2.1. MIHOPE Study Entry and Kindergarten Follow-Up Data Collection Timeline



NOTES: Data collection for Cohort 1 was fielded from January 2019 to June 2019. Data collection for Cohort 2 was fielded from September 2019 to April 2020. Data collection efforts for Cohorts 3 and 4 were fielded concurrently from January 2022 to July 2022 because of interruptions in the timeline due to the COVID-19 pandemic.

In March 2020, as the study team was concluding direct data collection efforts with families in Cohort 2, the United States began to experience and respond to the COVID-19 pandemic. In consultation with federal staff, the study team decided not to move forward with obtaining kindergarten follow-up data from Cohort 3 families during the 2020-2021 school year because conducting in-person data collection presented health risks for both families and data collectors at the time. It was also unclear whether and how schools would reopen for the 2020-2021 school year, and whether parents would choose to enroll their kindergarten-eligible children in formal schooling.⁷

Kindergarten data collection resumed during the 2021-2022 school year when children in Cohort 3 attended first grade and children in Cohort 4 attended kindergarten. Data collection for Cohorts 3 and 4 was fielded concurrently from January 2022 to July 2022. Because the pandemic continued to be a factor as the study team prepared for data collection, the study team adapted the data collection effort to be fully virtual.⁸ Throughout this report, the sample of children and families in Cohorts 3 and 4 is referred to as the “pandemic sample.” The sample of children and families in Cohorts 1 and 2 is referred to as the “pre-pandemic sample.”

The study’s response to the pandemic, as well as MIHOPE families’ experiences after the onset of the pandemic, are further described in Chapter 4.

ANALYTIC STRATEGY FOR EXAMINING EFFECTS

Early childhood home visiting programs are designed to affect a wide range of maternal, family, and child outcomes across multiple areas, as described in Chapter 1. Given this broad emphasis, MIHOPE collected data for its kindergarten follow-up from the multiple data sources described earlier, and the study team assessed impacts on 66 outcomes. As in earlier MIHOPE reports, these outcomes are organized into outcome areas. For this report, outcomes are further grouped into sub-areas. The outcome areas and sub-areas, along with an example outcome in each sub-area, are shown in Table 2.2.⁹

The study team used a series of tests to determine whether home visiting has an effect on these wide range of outcomes as measured at the kindergarten follow-up. The type of test used is called an omnibus test. The omnibus test considers the pattern of effects—that is, the magnitudes and directions of the effects—on a group of outcomes and tests the likelihood that this pattern of effects would have occurred if there were truly no effect.¹⁰ A sig-

7. Burbio (2022).

8. See Appendix I for additional information on the adaptation.

9. The sub-areas were first described in the study’s analysis plan, see Faucetta and Portilla (2025). See Appendix A of this report for all measure descriptions.

10. The omnibus test uses nonparametric combinations to assess the joint probability of observing the same or more favorable results under the sharp null hypothesis of no effects on any of the outcomes within the research question. See Caughey, Dafoe, and Seawright (2017).

Table 2.2. Kindergarten Outcome Areas and Sub-Areas

Outcome Area	Sub-Area	Example Outcome
Parenting	Parent-child relationship	Parental warmth
	Behavior toward child during semi-structured task	Parental sensitivity
	Aggression toward child	Frequency of physical aggression during the past year
	Child maltreatment	Any substantiated report of abuse since 15 months
	Parental support for learning and development	Reads to child daily
Maternal well-being	Maternal coping strategies	Mastery
	Parenting distress	Parenting distress
	Maternal depressive symptoms	Exhibits depressive symptoms
	Maternal substance use	Used illicit drugs
Family conflict and violence	Family conflict	Family conflict
	Intimate partner violence	Maternal experience with battering
Family economic circumstances	Education, employment, and income	Quarters employed in the past year
	Material hardship	Food insecurity
	Public assistance receipt	Medicaid
Child functioning	Social skills	Engagement
	Behavior problems	Internalizing behaviors
	Emotional and behavioral self-regulation	Emotional self-control
	Behavior toward parent during semi-structured task	Child engagement of parent
	Cognitive skills	Short-term memory
	Language development	Vocabulary knowledge
	Mathematics development	Early numeracy and math skills
	Quality of play during semi-structured task	Child quality of play

nificant p-value for the omnibus test indicates favorable effects for that set of outcomes.¹¹ Since the test uses the magnitude and the direction of the estimated effects on the program group, it is possible to find a significant p-value for the omnibus test even if there are no

11. A p-value indicates the likelihood that a pattern of effects would have been found by an intervention with zero true effects. An omnibus test is a type of global statistical test that collectively evaluates more than one null hypothesis.

statistically significant effects on any individual outcome within the set of outcomes.¹² This is particularly likely if the individual estimated effects for a set of outcomes are all in the same direction.¹³

This approach of analyzing groups of outcomes about child and family functioning with omnibus tests can be powerful in studying home visiting since impacts might be small but spread across many outcomes. With a wide range of outcomes, the broad and tailored nature of home visiting services may mean that home visiting is helping each family in some way even though the average effect on any single outcome is small. Because the likelihood of finding a false positive result (incorrectly rejecting the null hypothesis, or in other words, concluding that there is a statistically significant effect, when in reality there is no effect) or a false negative result (failing to reject the null hypothesis, or in other words, concluding that there is not a statistically significant effect when in reality there is an effect) increases when examining 66 outcomes, it is important to consider findings that look beyond individual effects rather than relying on a significant finding on any single outcome.

To group outcomes, the study team pre-specified eight topical research questions in the study's analysis plan. The research questions are shown in Table 2.3, along with the sub-areas that are used to answer each question.¹⁴ These topical research questions aim to provide information about the effects of home visiting on mothers, children and families, and were shaped by groups of favorable effects seen in earlier MIHOPE reports and the stated priorities of the four home visiting models included in MIHOPE. The research questions also consider whose behavior, skills, or well-being is reflected in the outcomes (mother, family, and/or child), as well as whether outcomes are more proximal to direct interactions between the home visitor and parent or more distal outcomes in the logic models of these four evidence-based home visiting models (such as children's functioning). The outcomes used to answer these questions are drawn from sub-areas across and within outcome areas, and some sub-areas contribute to answering more than one research question.

Previous MIHOPE follow-ups have also examined dozens of outcomes, consistent with the broad nature of home visiting as an intervention. To aid in the interpretation of effects across those outcomes, the analyses for the earlier follow-ups (at 15 months, and at 2.5

12. In performing the omnibus test, the study team resampled the program group indicator 1,000 times and recalculated the estimated effect for each outcome on each permutation of the sample. Comparing the estimated effects of the 1,000 permutations to the observed estimated effect and combining these comparisons across a set of outcomes, the resulting p-value indicates the probability that a given pattern of results would have been found if home visiting had no effects on the outcomes.

13. However, since both the direction *and* the magnitude of effects contribute to the p-value for the omnibus test, it is also possible for favorable effects on all contributing outcomes to result in a p-value that is not statistically significant.

14. See Faucetta and Portilla (2025). The research questions cover all sub-areas listed in Table 2.2, with the exception of quality of play during semi-structured task and public assistance receipt, resulting in the examination of 60 individual outcomes through omnibus tests. Refer to Appendix C for reasons why these outcomes were excluded and see Appendix Table C.9 for impact findings on the quality of play and public assistance receipt outcomes.

Table 2.3. Pre-Specified Topical Research Questions

Research Question	Sub-Area(s)
Did home visiting affect outcomes that could be improved through direct interaction between parents and home visitors?	Maternal coping strategies Parenting distress Parent-child relationship Aggression toward child Behavior toward child during semi-structured task Parental support for learning and development
Did home visiting affect maternal mental and behavioral health?	Maternal coping strategies Parenting distress Maternal depressive symptoms Maternal substance use
Did home visiting affect parent-child interactions?	Parent-child relationship Aggression toward child Behavior toward child during semi-structured task Behavior toward parent during semi-structured task Parental support for learning and development
Did home visiting affect conflict, violence, aggression, and maltreatment?	Family conflict Intimate partner violence Aggression toward child Child maltreatment
Did home visiting affect families' economic circumstances?	Education, employment, and income Material hardship
Did home visiting affect children's social-emotional functioning in the home context?	Social skills Behavior problems Emotional and behavioral self-regulation Behavior toward parent during semi-structured task
Did home visiting affect children's social-emotional functioning in school settings?	Social skills Behavior problems Emotional and behavioral self-regulation
Did home visiting affect children's cognitive, language, and early math skills?	Cognitive skills Language development Mathematics development

and 3.5 years) used two strategies.¹⁵ The primary strategy used in the earlier analyses was to designate a small set of outcomes as confirmatory, with the remainder designated as exploratory.¹⁶ Effects were analyzed for the individual outcomes, and the effects for the confirmatory outcomes were emphasized in reporting the effects of home visiting. This approach is consistent with that used in many other intervention studies and is consistent with guidance for testing multiple outcomes in impact evaluations.¹⁷ However, because early childhood home visiting programs are designed to affect a wide range of maternal and child outcomes across multiple areas, the study team recognized that elevating a small set of individual outcomes might not be the only effective approach to understanding the effects of this intervention. The study team added a secondary strategy in the earlier analyses, also using omnibus tests to aid in the interpretation of effects across groups of outcomes for the 15-month and 2.5- and 3.5-year follow-ups.

In planning for the kindergarten analyses, the study team decided that analyzing effects collectively for groups of outcomes would be the most effective approach for understanding the effects of home visiting five to seven years after families began receiving home visiting services.

The next chapter presents the estimated effects for each of the topical research questions, using this analytic approach.

15. See Michalopoulos et al. (2019) and Faucetta, Michalopoulos, Portilla, and Saunders (2023).

16. Outcomes were designated as confirmatory based on prior evidence of positive effects on that outcome, the policy relevance of the outcome, and the quality of the tools available to measure the outcome. Outcomes were otherwise designated as exploratory, when prior home visiting studies had not found effects, or outcomes had not been examined in previous studies. Some exploratory outcomes provided information that can shed more light on a confirmatory outcome. Others represented areas where home visiting programs have increased their effects over time and where there might now be benefits for families.

17. Schochet (2008).

3

Estimated Effects of Home Visiting on Maternal, Family, and Child Well-Being

This chapter presents results that answer eight pre-specified research questions that examine the estimated effects of home visiting on maternal, family, and child well-being at the kindergarten follow-up. These estimated effects were assessed five to seven years after families began receiving home visiting services, which means that families were no longer in direct contact with their home visitors. Families in MIHOPE, on average, participated in home visiting services for approximately 8 of the 12 months following their first visit.¹

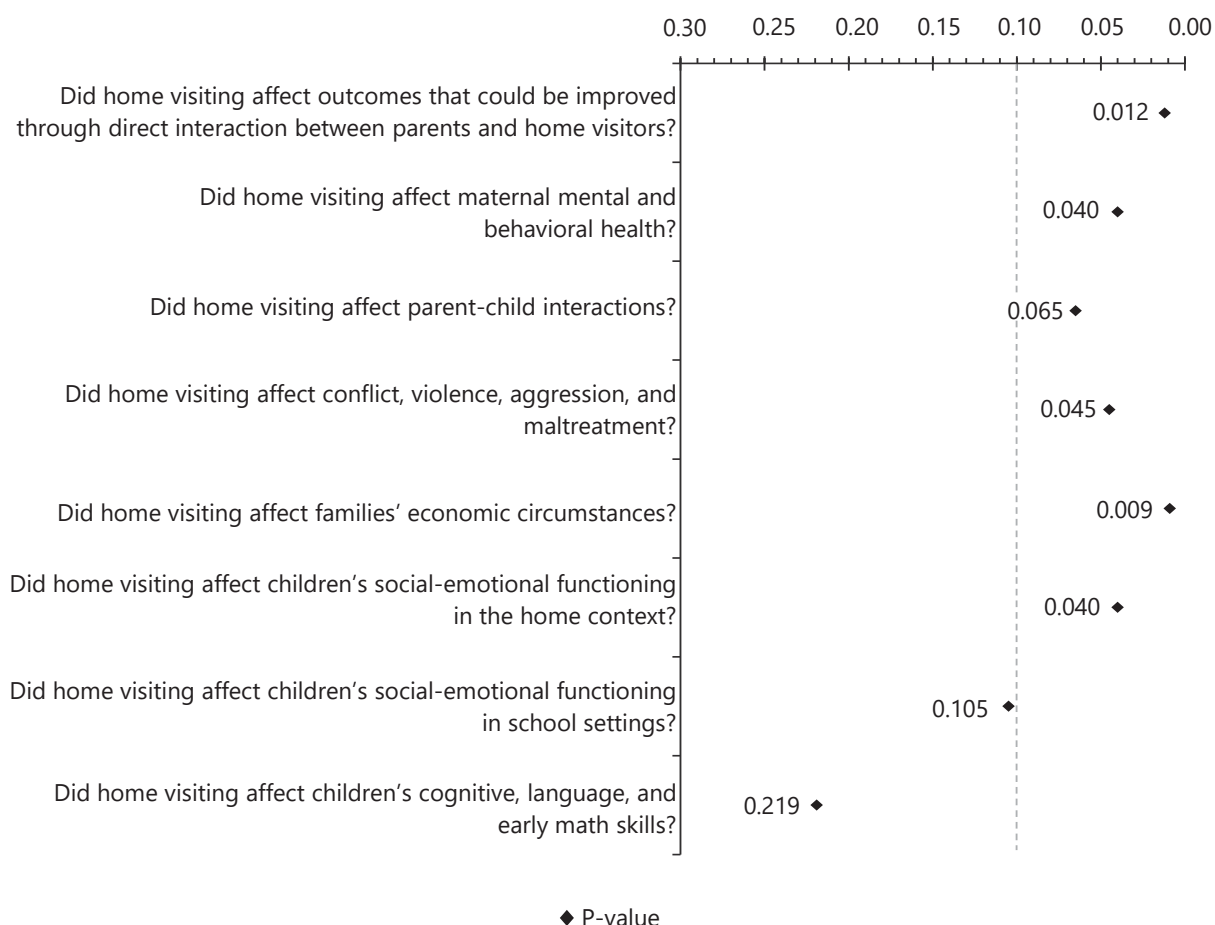
SUMMARY OF FINDINGS

As described in Chapter 2, omnibus tests are used to interpret the pattern of effects across the outcomes that answer each research question using the full kindergarten analysis sample. A summary of the omnibus test results (p-values) for these research questions is shown in Figure 3.1. The next sections describe the results and overall patterns of effects, along with the rationale for each research question and the data sources that contribute to the outcomes used to answer each research question. Refer to Box 3.1 to understand how to interpret the information in Figures 3.2 through 3.9.

- **MIHOPE found statistically significant and positive effects of home visiting for the five research questions that measured maternal and family well-being outcomes.** The results of the omnibus tests indicate that home visiting had favorable effects on outcomes more readily impacted by direct interactions or services provided by home visitors. These include (1) maternal coping strategies and parenting behaviors that could be improved through direct interaction between parents and home visitors; (2) maternal mental and behavioral health; (3) parent-child interactions; (4) a constellation of outcomes related to conflict, violence, aggression, and maltreatment; and (5) families' economic circumstances.

1. Duggan et al. (2018).

Figure 3.1. Summary of Omnibus Test Results for Topical Research Questions



NOTE: For each research question, an omnibus test was used to assess the joint probability of observing the same or more favorable results if there were no effects on a set of outcomes. A statistically significant result is determined by a p-value less than 0.10, represented by the area to the right of the dashed line.

- MIHOPE found some evidence of positive effects of home visiting for the three research questions related to child functioning outcomes.** The result of the omnibus test for children's social-emotional functioning in the home context was statistically significant and positive. A similar pattern of effects emerged on outcomes related to children's social-emotional functioning in school settings, but the omnibus test result was not statistically significant, potentially due to the smaller sample of teachers who reported on these measures. The omnibus test result was also not statistically significant for the research question related to children's cognitive, language, and math skills.

Supplemental analyses examine whether there are differences based on the timing of data collection or by the grade of the child at follow-up. Across the eight research questions, there were minimal differences in estimated effects when the samples were split by the timing of data collection (pre-pandemic versus pandemic samples; see Appendix D) and by

BOX 3.1

How to Interpret Estimated Effects in Figures 3.2 Through 3.9

Figures 3.2 through 3.9 show estimated effects for the outcomes that contribute to answering each of the eight topical research questions, organized by sub-area. As described in Chapter 2, the main impact analysis focuses on answering eight pre-specified research questions using omnibus tests that describe the pattern of effects across all the outcomes that contribute to answering each research question. The figures visually demonstrate the magnitude and directionality of effects that contribute to the omnibus test results. As shown in Figure 3.2, for example, the omnibus test indicates an overall pattern of positive effects for this research question; estimated effects are small and positive for most outcomes, even though few estimated effects are statistically significant for individual outcomes.

For each individual outcome, the effects of home visiting are estimated by comparing the outcomes of the program and control groups, adjusted for background characteristics of the sample members. The figures show the estimated effects for the study's outcomes as circles. For example, in Figure 3.2, there is a small, negative estimated effect on resource mobilization but a small, positive estimated effect on mastery. All results are presented as effect sizes, which is a way of standardizing outcomes so they are on the same scale.

The lines surrounding the estimated effect in the figures represent the 90 percent confidence interval of the effect size, which is an estimate of the variability (or statistical imprecision) of the effects. A narrower confidence interval suggests a more precise estimate than a wider confidence interval; a wider interval indicates greater variability and thus greater uncertainty. Confidence intervals that do not contain zero (those fully to the right or the left of the zero line) indicate that the effect is different from zero to a statistically significant degree, using 10 percent as the benchmark for statistical significance. That is, there is less than a 10 percent chance of finding an estimated effect this big if the true effect of the program were zero. For example, Figure 3.2 shows that the effect is different from zero to a statistically significant degree for perceived social support.

In the figures, all outcomes are shown such that positive results indicate more favorable outcomes for families. To achieve this presentation, outcomes for which negative effects indicated more favorable outcomes for families were reversed. For example, the direction of effects for the parenting distress outcome was reversed; the positive estimated effect shown for parenting distress indicates a favorable outcome for families (in other words, program group families experienced less parenting distress than control group families). These reversed outcomes are shown in italics.

grade (kindergarten versus first grade; see Appendix E). These results support pooling the data and analyzing the main effects for the full sample to assess the impacts of home visiting on these outcomes at the transition to formal schooling.

ESTIMATED EFFECTS OF HOME VISITING ON MATERNAL AND FAMILY OUTCOMES

Home visiting aims to improve the health and well-being of families and children, primarily through working with the parent to promote a supportive parent-child bond and improve the families' household environment such as the relational dynamics between family members. It also provides families with referrals to other services in their communities to further address families' needs, such as to increase maternal health and well-being or improve the families' economic outcomes. It is through these more proximal mechanisms at the maternal and family levels that programs aim to have a lasting impact on children's functioning and development.

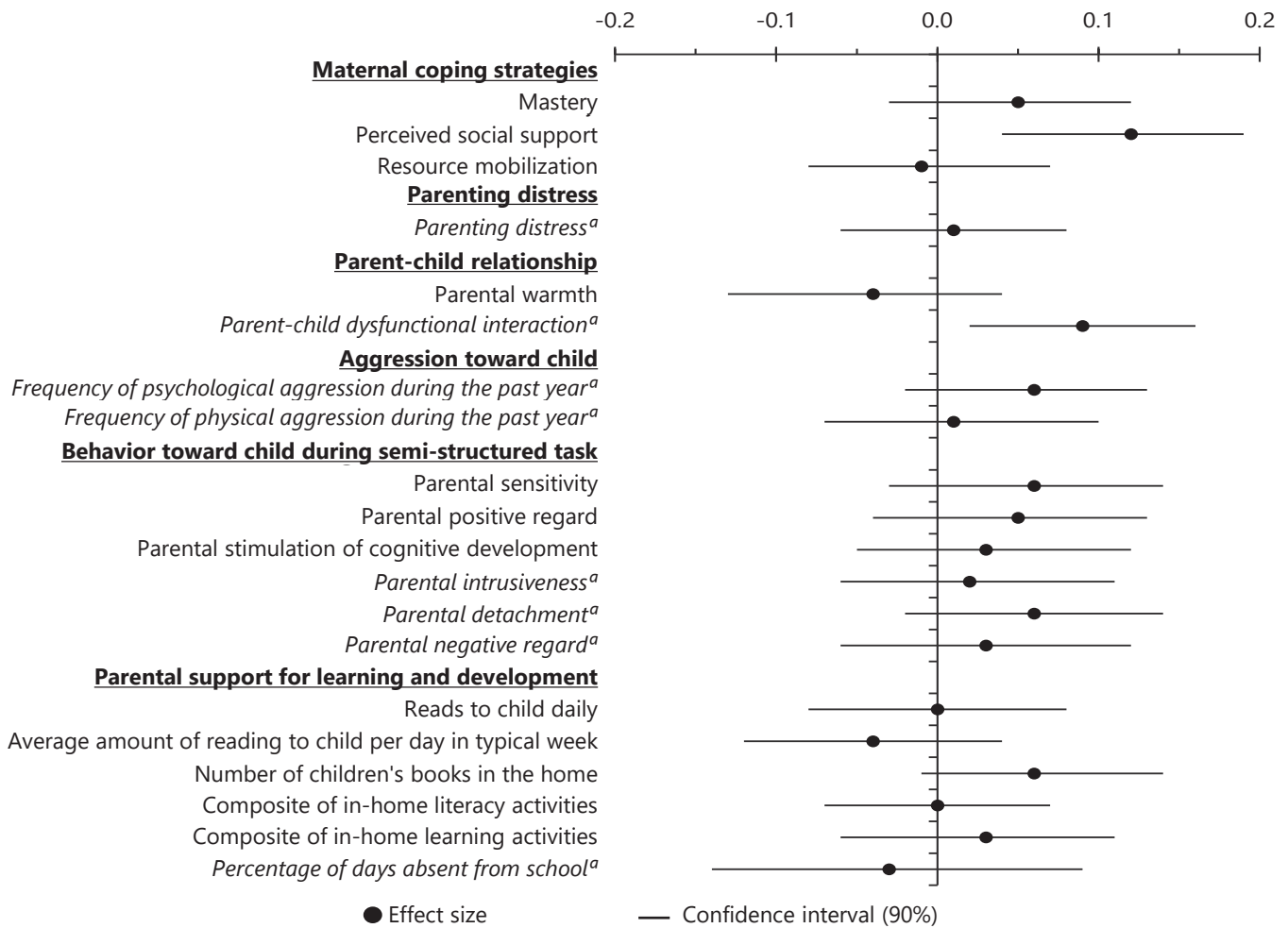
To examine the effects of home visiting on outcomes more readily impacted by direct interactions or services provided by home visitors, the kindergarten follow-up examined the following five research questions:

- Did home visiting affect outcomes that could be improved through direct interaction between parents and home visitors?
- Did home visiting affect maternal mental and behavioral health?
- Did home visiting affect parent-child interactions?
- Did home visiting affect conflict, violence, aggression, and maltreatment?
- Did home visiting affect families' economic circumstances?

Did Home Visiting Affect Outcomes That Could Be Improved Through Direct Interaction Between Parents and Home Visitors?

MIHOPE found that home visiting had an overall statistically significant and positive effect on maternal coping strategies and parenting behaviors that are directly targeted by strategies and information provided by home visitors during home visits. This conclusion is based on the results of the omnibus test conducted to answer this question ($p = 0.012$), which collectively analyzed effects for all 20 outcomes in the six sub-areas shown in Figure 3.2: maternal coping strategies, parenting distress, parent-child relationship, aggression toward

Figure 3.2. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.012.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for families. For example, the direction of effects for the parenting distress outcome was reversed; the positive estimated effect shown for parenting distress indicates a favorable outcome for families (in other words, program group families experienced less parenting distress than control group families).

child, behavior toward child during semi-structured task, and parental support for learning and development.²

This first research question examined sub-areas with outcomes hypothesized to be the most proximal or directly affected by the interactions the home visitor has with the parent while in the home—namely, those concerning maternal coping strategies and parenting behaviors. As described in Chapter 1, home visiting generally consists of three types of activities: assessing family needs, educating and supporting parents, and referral and coordination with local service agencies. The first two activities involve direct interactions between the home visitor and the parent in the home. To identify family strengths and needs, home visitors gather information from families through formal screening and assessment on various outcome areas. Yet the approach is also client-led, working directly with families to identify needs and interests through other means such as talking openly about goals or picking up on cues from family members. Once family needs are identified, home visitors devote most of their time in home visits to providing education and support to families.

As described in the MIHOPE implementation report, most home visitors from the four models included in MIHOPE view the parent-child relationship as foundational and ascribe to the basic tenet that parents are “the first teachers” in a child’s life.³ To support parents, home visitors provide them with information on topics such as children’s developmental stages and provide feedback on their parenting using methods such as positive reinforcement, direct suggestions and encouragement, role-playing, and motivational interviewing to support healthy and positive behavior. In addition, home visitors work to strengthen families’ support networks. Ultimately, home visitors seek to empower parents via a strengths-based and family-centered approach, particularly through promoting positive parenting behaviors and practices. A strengths-based approach typically refers to a service delivery strategy that centers on being client-led and client-directed, and emphasizes the tools, skills, resources, and agency that families bring to a situation.⁴

Meanwhile, referrals and coordination with local service agencies require not only the availability of services in the community but also depend on the accessibility and quality of those services and family engagement to pursue those services, which home visitors do not have direct control over. The MIHOPE implementation report highlights these challenges, as well as the difficulties addressing mental and behavioral risks in families with greater need who may not be able to follow through on referrals to services that can help address them.⁵ However, the kindergarten follow-up did not explicitly examine whether effects resulted from the referrals provided to the MIHOPE families by home visitors during service delivery. Instead, the kindergarten follow-up was designed to determine whether home visiting

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2. Details of estimated effects for outcomes that contribute to answering whether home visiting affected parenting behavior and other outcomes directly targeted by home visitors are shown in Appendix Table C.1.
 3. Duggan et al. (2018).
 4. Weick, Rapp, Sullivan, and Kisthardt (1989).
 5. Duggan et al. (2018).

services have a favorable effect on outcomes more proximal to the education and support home visitors can directly provide in the home, as well as outcomes in other areas that may be dependent on connections to other services. The statistically significant and favorable finding at kindergarten for this research question shows that home visiting can have a lasting effect on outcomes most proximal to the intervention delivered in homes. The data used to measure the 20 outcomes for these sub-areas were collected from multiple informants: children’s caregivers via a caregiver survey, field interviewers’ ratings during the in-home direct child assessment, and independent observers’ ratings using a semi-structured play task conducted in the home. Data were also collected via school records.

Did Home Visiting Affect Maternal Mental and Behavioral Health?

MIHOPE found that home visiting had an overall statistically significant and positive effect on maternal mental and behavioral health. This conclusion is based on the results of the omnibus test conducted to answer this question ($p = 0.040$), which collectively analyzed effects for all seven outcomes in the four sub-areas shown in Figure 3.3: maternal coping strategies, parenting distress, maternal depressive symptoms, and maternal substance use.⁶

This finding fills a large gap in the evidence of home visiting programs’ effects on maternal mental and behavioral health. As Chapter 1 showed, prior studies of the four models included in MIHOPE rarely examined outcomes related to maternal mental health and substance use. However, since those studies were conducted, home visiting programs have increasingly recognized maternal mental health and substance use as important areas to address, as they are important aspects of maternal well-being. The legislation that authorized the MIECHV Program identified maternal health as one of the benchmark areas in which awardees’ early childhood home visiting programs were required to work toward demonstrating improvements.⁷

The effects of the MIECHV requirements were seen in the prioritization reported by evidence-based models and local programs, and the early evidence from MIHOPE. At the time MIHOPE began, of the four evidence-based models, Nurse-Family Partnership and Healthy Families America indicated that they placed a high priority on maternal health. Early Head Start and Parents as Teachers indicated they placed a medium priority on this outcome area.⁸ However, thirty-five percent of the local home visiting programs studied in MIHOPE indicated they had raised the priority they placed on maternal mental health and substance use since MIECHV was first authorized.⁹ MIHOPE subsequently found a reduction in maternal depression in the 15-month follow-up, which may have been related to the increased

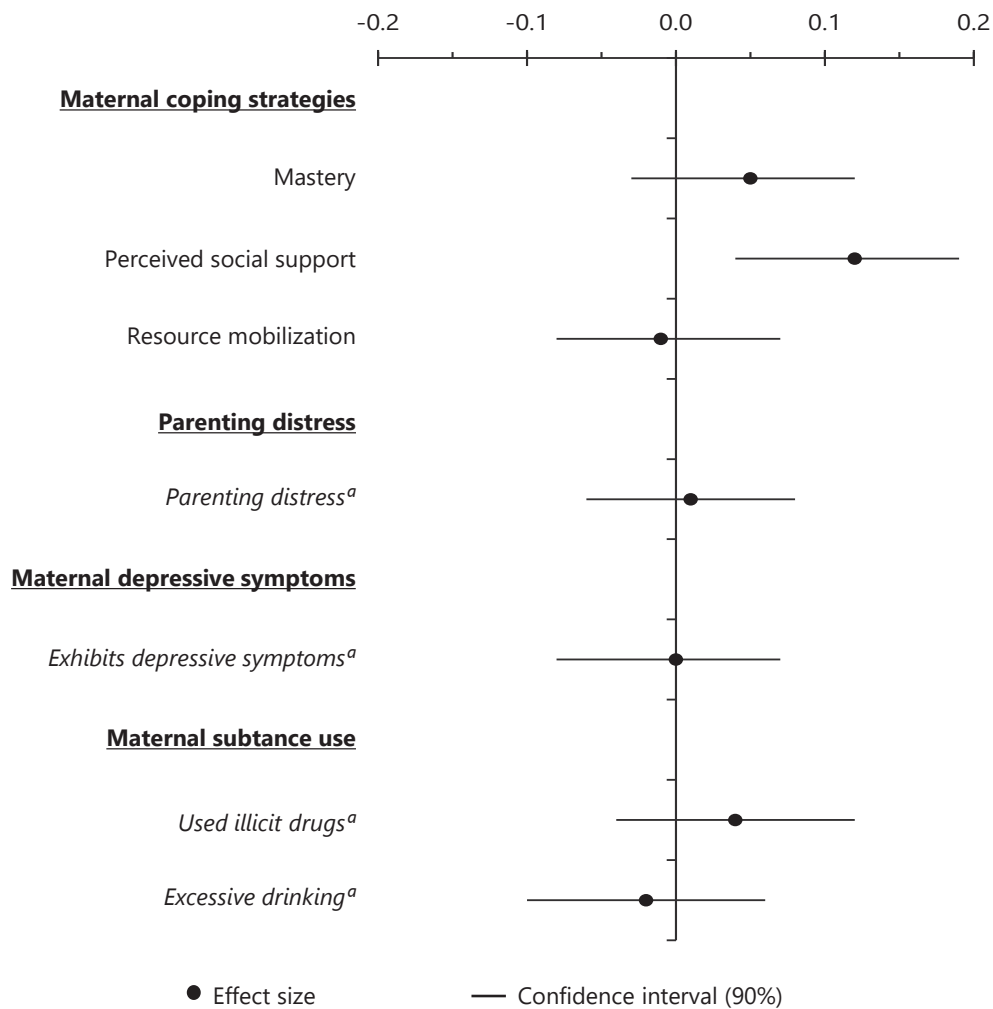
6. Details of estimated effects for outcomes that contribute to answering the maternal mental and behavioral health research question are shown in Appendix Table C.2.

7. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi); SEC. 511 [42 U.S.C. 711] (d) (2) (B) (i-vii).

8. Michalopoulos et al. (2015).

9. Michalopoulos et al. (2015).

Figure 3.3. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.040.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for families. For example, the direction of effects for the parenting distress outcome was reversed; the positive estimated effect shown for parenting distress indicates a favorable outcome for families (in other words, program group families experienced less parenting distress than control group families).

attention home visiting programs have given to maternal mental health in recent years.¹⁰ This was additional motivation for including a research question on maternal mental and behavioral health in the kindergarten analysis.

Today, home visiting programs try to support mothers who may have mental or behavioral health difficulties by screening and referring them to other services as needed. The result of these efforts five to seven years later is a set of favorable effects for mothers, which may have implications for mothers' own long-term well-being, as well as their ability to support their children's well-being. The data used to measure these seven outcomes were collected from children's caregivers via a caregiver survey.

Did Home Visiting Affect Parent-Child Interactions?

MIHOPE found that home visiting had an overall statistically significant and positive effect on parent-child interactions. This conclusion is based on the results of the omnibus test conducted to answer this question ($p = 0.065$), which collectively analyzed effects for all 18 outcomes in the five sub-areas shown in Figure 3.4: parent-child relationship, aggression toward child, behavior toward child during semi-structured task, behavior toward parent during semi-structured task, and parental support for learning and development.¹¹

This finding is consistent with the fact that strengthening the parent-child bond is a core aspect of home visiting services. The evidence-based home visiting models included in MIHOPE all aim to affect parenting practices and the development of nurturing and supportive relationships between parents and their children, as shown in their logic models.¹² Close relationships and competent care provide young children with the foundation for healthy child development; these targets of the intervention are theorized to result in improved child functioning.¹³ Additionally, exposure to cognitively stimulating materials and activities and an enriched home literacy environment can improve children's school readiness skills. Time spent engaging in in-home activities with parents has been shown to have positive effects on children's cognitive development and academic achievement.¹⁴

Though a primary aim of home visiting services, there are scant examinations of parenting outcomes for the four home visiting program models at this follow-up age. Two studies, one of Early Head Start and one of Healthy Families America, examined a total of 11 outcomes, finding six effects to be statistically significant (see Figure 1.1). These individual impacts

10. Michalopoulos et al. (2019).

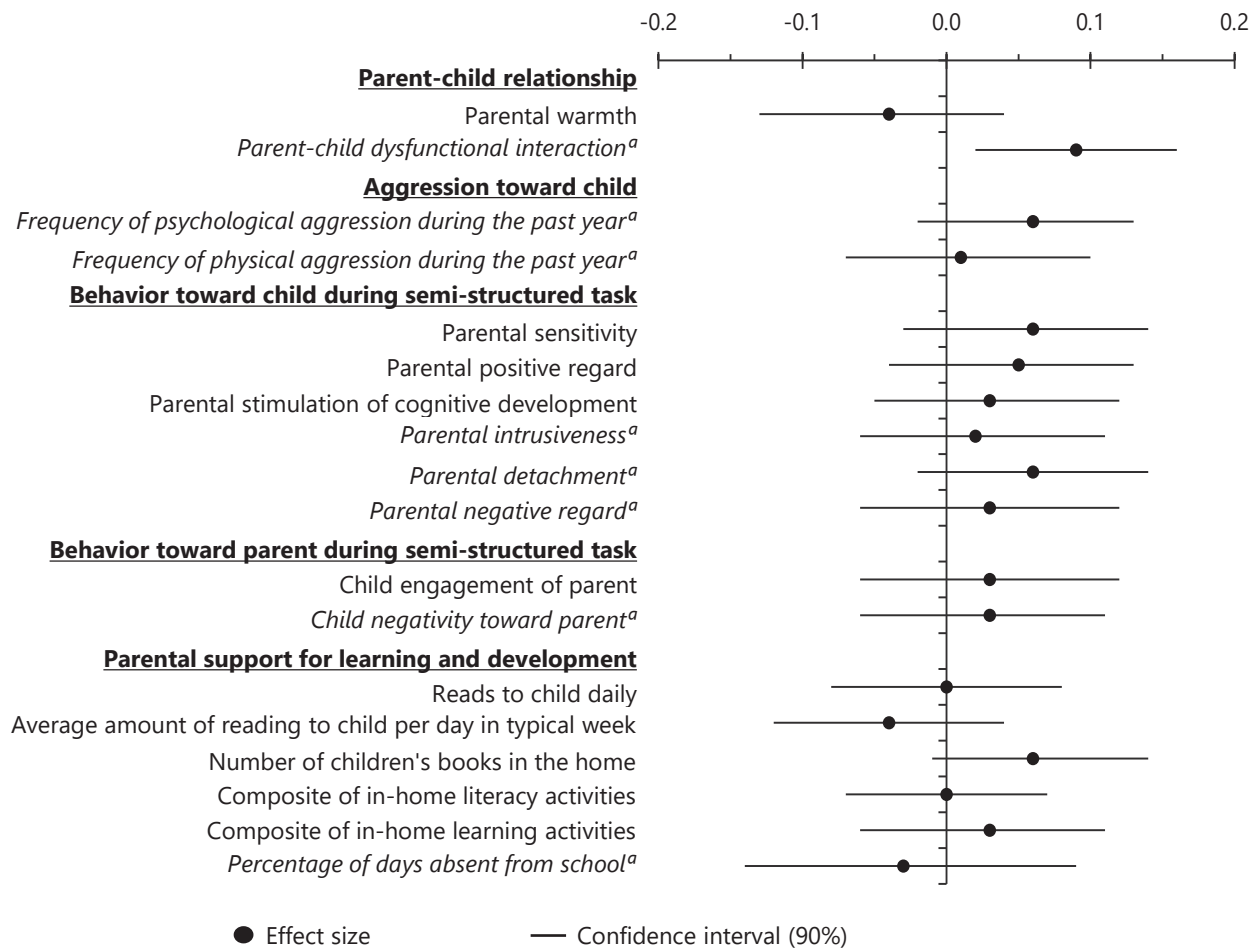
11. Details of estimated effects for outcomes that contribute to answer the parent-child interactions research question are shown in Appendix Table C.3.

12. U.S. Department of Health and Human Services, Administration for Children and Families, Office of Head Start (2025); Healthy Families America logic model; Nurse-Family Partnership logic model; and Parents as Teachers National Center (2023). The Healthy Families America and Nurse-Family Partnership logic models were obtained from communication with the model developers.

13. Duggan et al. (2018).

14. Fiorini and Keane (2014); Kalil and Mayer (2016); Bodovski and Farkas (2008).

Figure 3.4. Estimated Effects on Parent-Child Interactions at Kindergarten



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.065.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for families. For example, the direction of effects for the parental intrusiveness outcome was reversed; the positive estimated effect shown for parental intrusiveness indicates a favorable outcome for families (in other words, program group families experienced less parental intrusiveness than control group families).

were clustered in parental support for learning and development and non-violent discipline practices.¹⁵ However, early evidence from MIHOPE at the 15-month follow-up saw a constellation of statistically significant favorable impacts on outcomes related to the overall quality of the home environment, parental support for children’s learning and literacy, parental sensitivity, psychological aggression toward the child, and discipline strategies.¹⁶

That home visiting has a lasting impact on the interactions between parent and child highlights the importance of supporting parents in the early years to lay the foundation for a positive relational bond, as evidenced by the large number of small but positive impacts on individual outcomes featured in this research question. The data used to measure the 18 outcomes for these sub-areas were collected from multiple informants: children’s caregivers via a caregiver survey, field interviewers’ ratings during the in-home direct child assessment, and independent observers’ ratings using a semi-structured play task conducted in the home. Data were also collected via school records.

Did Home Visiting Affect Conflict, Violence, Aggression, and Maltreatment?

MIHOPE found that home visiting had an overall statistically significant effect on reducing conflict, violence, aggression, and maltreatment. This conclusion is based on the omnibus test conducted to answer this research question ($p = 0.045$), which collectively analyzed all nine outcomes in the four sub-areas shown in Figure 3.5: family conflict, intimate partner violence, aggression towards child, and child maltreatment.¹⁷

Home visiting programs aim to affect the development of nurturing and supportive relationships between parents and their children. They strive to reduce negative behaviors and conflict among family members by reducing aggressive parenting behaviors, including those that rise to the level of child maltreatment, and by reducing intimate partner violence between adults. All four evidence-based models included in MIHOPE placed a high priority on preventing and reducing child maltreatment when MIHOPE began.¹⁸ Moreover, Healthy Families America says its mission is to prevent child maltreatment, and Nurse-Family Partnership and Parents as Teachers listed the prevention and reduction of child maltreatment as explicit program outcomes. Two evidence-based models studied in MIHOPE, Healthy Families America and Nurse-Family Partnership, placed a high priority on preventing and reducing intimate partner violence when MIHOPE began.¹⁹ While intimate partner violence has not historically been a focus of all early childhood home visiting programs, the

15. Dumont et al. (2010); Chazan-Cohen, Raikes, and Vogel (2013).

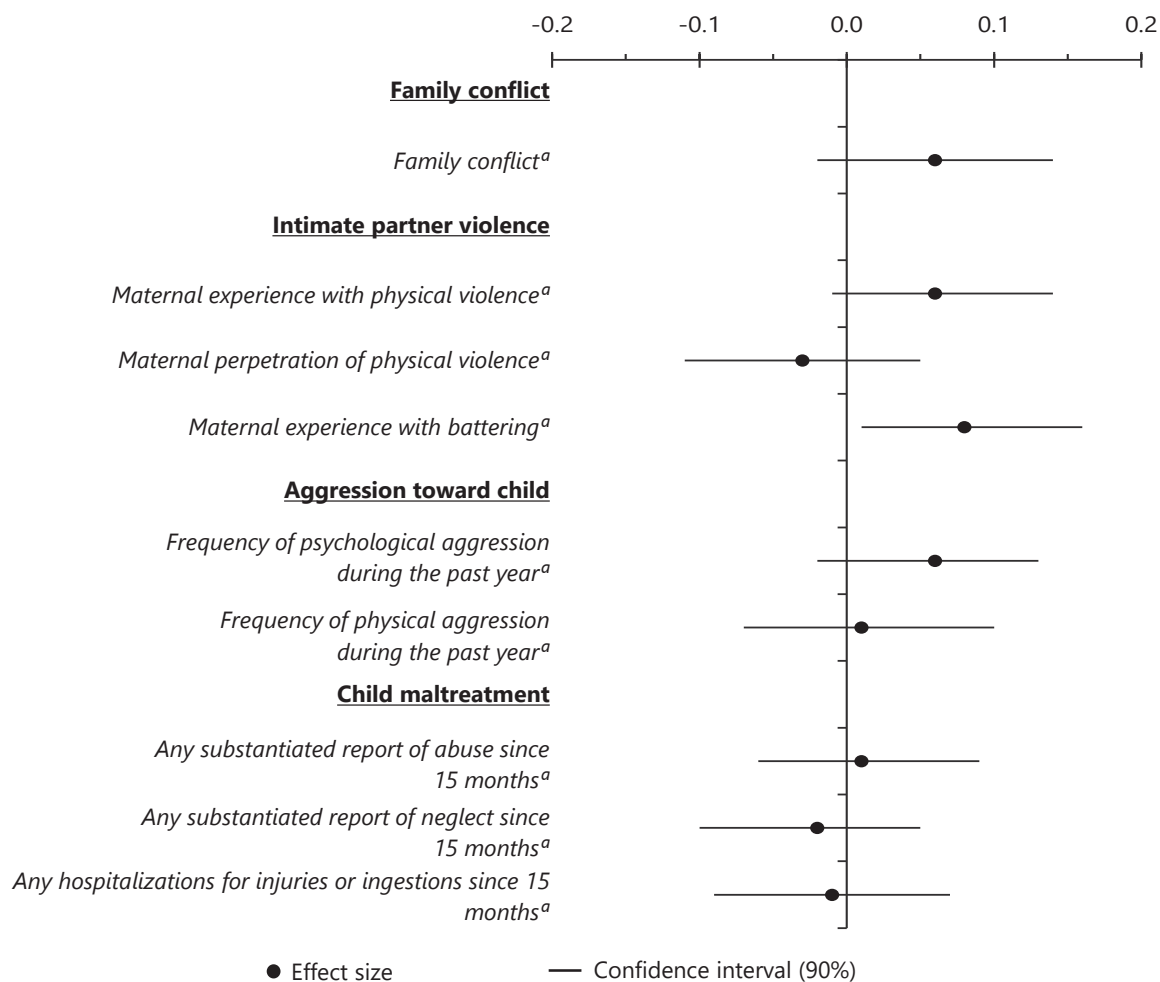
16. Michalopoulos et al. (2019).

17. Details of estimated effects for outcomes that contribute to answering the conflict, violence, aggression, and maltreatment research question are shown in Appendix Table C.4.

18. Michalopoulos et al. (2015).

19. See Michalopoulos et al. (2015). Additionally, families with histories of intimate partner violence are one of the groups Healthy Families America has sought to serve.

Figure 3.5. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.045.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for families. For example, the direction of effects for the family conflict outcome was reversed; the positive estimated effect shown for family conflict indicates a favorable outcome for families (in other words, program group families experienced less family conflict than control group families).

legislation that authorized MIECHV listed domestic violence as a benchmark area that home visiting programs should try to address.²⁰

Given Healthy Families America’s historical prioritization of reducing child maltreatment, it is not surprising that there have been 24 prior examinations related to child maltreatment and aggression toward children around this time point, three of which were statistically significant (see Figure 1.1). There is less evidence for the effect of the other three models on child maltreatment. Although family violence and conflict outcomes have rarely been examined in prior studies,²¹ the reduction in household aggression seen in the MIHOPE follow-up that occurred around the time children were 15 months of age (including on the frequency of psychological aggression toward children, and mothers’ experience with intimate partner violence) provides further motivation for the inclusion of this research question.²² Given the increased focus of home visiting programs on reducing outcomes related to family conflict and violence, this statistically significant and favorable finding fills a large gap in the evidence, particularly across the four models included in MIHOPE. The data used to measure the nine outcomes for these sub-areas were collected from children’s caregivers via a caregiver survey, administrative records from state child welfare agencies, and federal Medicaid claims records.

Did Home Visiting Affect Families’ Economic Circumstances?

MIHOPE found that home visiting had an overall statistically significant and positive effect on families’ economic circumstances. This conclusion is based on the results of the omnibus test conducted to answer this research question ($p = 0.009$), which collectively analyzed all eight outcomes organized into the two sub-areas shown in Figure 3.6: education, employment, and income; and material hardship.²³

Home visiting programs strive to improve families’ economic security by connecting them to employment opportunities or supporting mothers in their education and training endeavors—all with the goal of eventually improving employment opportunities and income. All four evidence-based models placed a high priority on improving economic self-sufficiency when MIHOPE began, and the legislation that authorized the MIECHV Program indicated that family economic self-sufficiency was one of the benchmark areas in which awardees’ early childhood home visiting programs were required to work toward demonstrating improvements.²⁴ However, even with that high prioritization, the evidence from prior studies of the four models included in MIHOPE around this time point in children’s lives comes primarily from two stud-

20. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi); SEC. 511 [42 U.S.C. 711] (d) (2) (B) (i-vii).

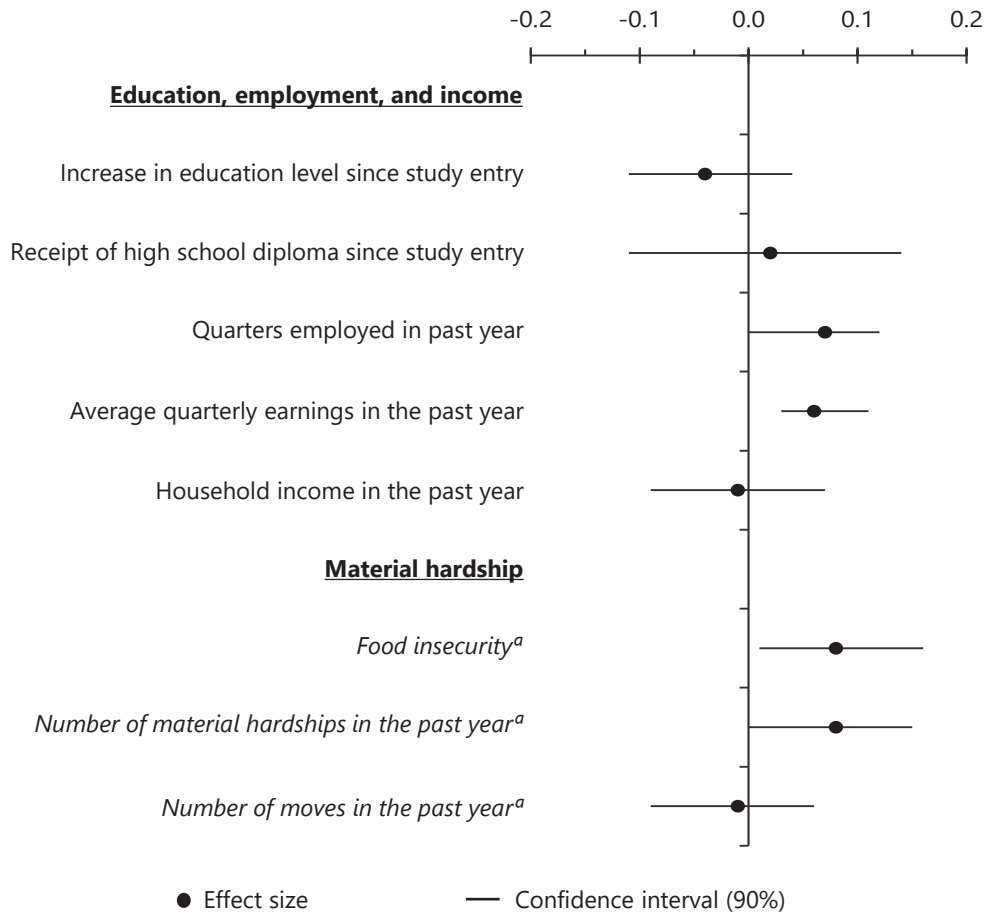
21. There have been two examinations in prior studies.

22. Michalopoulos et al. (2019).

23. Details of estimated effects for outcomes that contribute to answering the economic circumstances research question are shown in Appendix Table C.5.

24. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi); SEC. 511 [42 U.S.C. 711] (d) (2) (B) (i-vii).

Figure 3.6. Estimated Effects on Economic Circumstances at Kindergarten



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.009.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for families. For example, the direction of effects for the food insecurity outcome was reversed; the positive estimated effect shown for food insecurity indicates a favorable outcome for families (in other words, program group families experienced less food insecurity than control group families).

ies of Nurse-Family Partnership, which examined effects on outcomes related to education, neighborhood disadvantage, family stability, public benefits, and employment.²⁵

Earlier evidence from the MIHOPE 15-month follow-up found that the home visiting programs included in MIHOPE did not have a statistically significant effect on whether the mother was receiving education or training at the time of the follow-up survey. For the most part, home visiting also did not affect the exploratory measures related to economic self-sufficiency, with the exception of food insecurity—program group families were less likely to report food insecurity than control group families.²⁶ However, the kindergarten follow-up found a set of small and positive statistically significant findings for outcomes related to education, employment, income, and material hardship. This result provides evidence that home visiting can have a lasting impact in this area across the four evidence-based models included in MIHOPE. It may be that home visiting’s impact on families’ economic circumstances is less visible until children transition to formal schooling and mothers have more flexibility to increase their work hours or go back to school.²⁷ Data used to measure these eight outcomes were collected from children’s caregivers via a caregiver survey and from employment and earnings data obtained through the National Directory of New Hires.

ESTIMATED EFFECTS OF HOME VISITING ON CHILD OUTCOMES

The legislation that authorized MIECHV identified children’s school readiness as one of the benchmark areas in which MIEHCV-funded home visiting programs are expected to demonstrate improvement.²⁸ While home visitors engage in many activities to promote positive parenting behaviors, as well as encourage parents to partake in activities aimed at promoting healthy child development, it can take time for the effects of these activities to be reflected in children’s functioning and their readiness for school.

Earlier waves of MIHOPE found improvements in maternal and family functioning outcomes; this suggests that home visiting could result in program impacts on children’s functioning in kindergarten in a variety of sub-areas. In particular, the evidence from the MIHOPE check-ins with families when the children were 2.5 and 3.5 years old found favorable effects on exploratory outcomes related to the home literacy environment and cognitive stimulation parents were providing. There was also emerging evidence of effects on children’s behavioral self-regulation.²⁹ The kindergarten time point, therefore, permitted an examination of whether and how these earlier effects on parenting behaviors and child development might persist.

25. A study of Early Head Start examined effects on housing stability, income, and employment, and a study of Parents as Teachers examined effects on benefit receipt.

26. Michalopoulos et al. (2019).

27. Gelbach (2002).

28. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi); SEC. 511 [42 U.S.C. 711] (d) (2) (B) (i-vii).

29. Faucetta, Michalopoulos, Portilla, and Saunders (2023).

The MIHOPE kindergarten follow-up also provided an opportunity to understand children’s functioning in both the home and school contexts. Parents and teachers provide different perspectives on children’s functioning, which may be displayed differently in the home or at school. Both parents’ and teachers’ scores may be affected by reference bias: how they rate children’s behavior may be influenced by the behavior of other children they interact with. Parents, for example, may compare their children’s behaviors to the behavior of siblings or other children they know. Similarly, teachers may assess children’s functioning relative to their classmates. The COVID-19 pandemic provided an additional rationale for examining effects for the home and school context separately. It was unclear if and how stressors might have affected teachers and parents differentially, and how that may have affected how they rated children’s behaviors, compared to how they would have rated them before the pandemic. For these reasons, the report examines child functioning outcomes based on the context where they were observed (for instance, children’s social-emotional functioning in classrooms reported by teachers versus similar behaviors in the home reported by caregivers).

To examine the downstream effects of home visiting on children’s functioning, the kindergarten follow-up examined the following three research questions:

- Did home visiting affect children’s social-emotional functioning in the home context?
- Did home visiting affect children’s social-emotional functioning in school settings?
- Did home visiting affect children’s cognitive, language, and math skills?

Did Home Visiting Affect Children’s Social-Emotional Functioning in the Home Context?

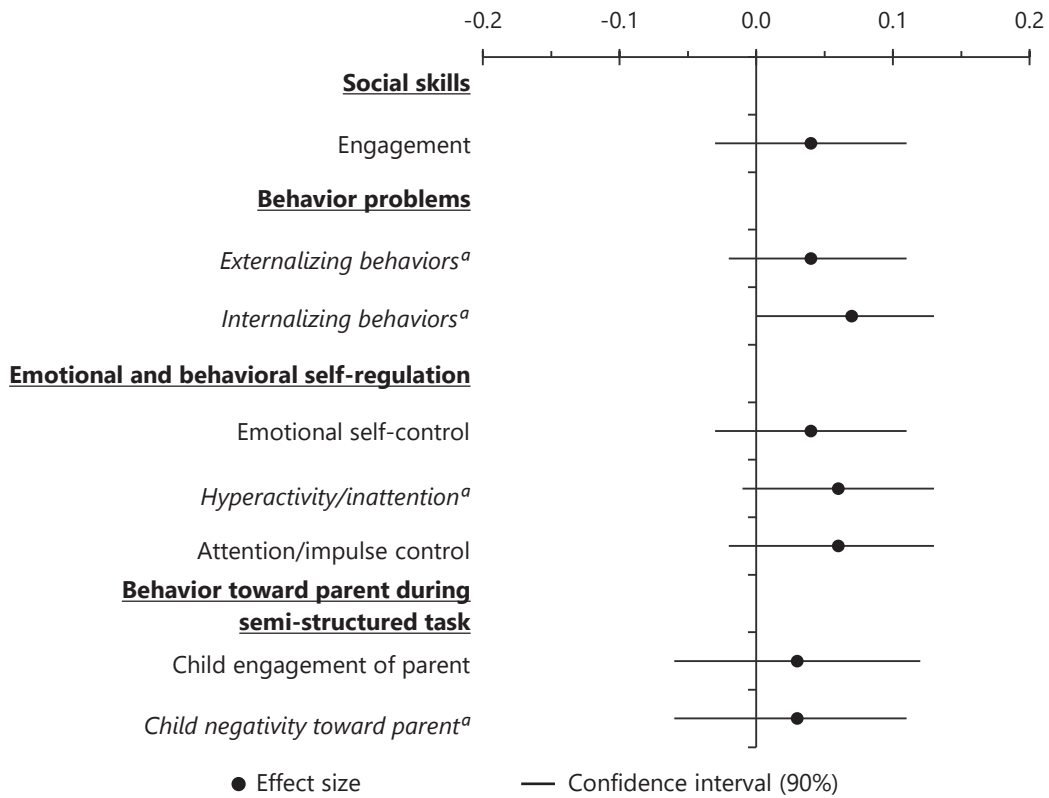
MIHOPE found that home visiting had an overall statistically significant and positive effect on children’s social-emotional functioning in the home context. This conclusion is based on the results of the omnibus test conducted to answer this research question ($p = 0.040$), which collectively analyzed all eight outcomes in the four sub-areas shown in Figure 3.7: social skills, behavior problems, emotional and behavioral self-regulation, and behavior toward parent during semi-structured task.³⁰

This finding aligns with the emphasis that all four evidence-based models included in MIHOPE place on improving children’s social and self-regulatory skills and reducing behavior problems. It also addresses a gap in the literature. While MIHOPE saw early evidence of the effects of home visiting on reduced child behavior problems at the 15-month follow-up,³¹ children’s social-emotional outcomes at ages 5 through 7 had largely been understudied in prior evaluations of home visiting. Evaluations of three of the four home visiting programs included in the MIHOPE evaluation examined impacts on children’s social-emotional

30. Details of estimated effects for outcomes that contribute to answering whether home visiting affected children’s social-emotional functioning in the home context are shown in Appendix Table C.6.

31. Michalopoulos et al. (2019).

Figure 3.7. Estimated Effects on Children’s Social-Emotional Functioning in the Home Context at Kindergarten



SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.040.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for children. For example, the direction of effects for the externalizing behaviors outcome was reversed; the positive estimated effect shown for externalizing behaviors indicates a favorable outcome for children (in other words, program group children experienced less externalizing behaviors than control group children).

functioning but the evidence is mixed. While there was a statistically significant impact on parent reports of total behavior problems in a follow-up study of Nurse-Family Partnership at age 6, evaluations of Early Head Start, Healthy Families America, as well as another of Nurse-Family Partnership, did not show statistically significant impacts on parent reports of behavior problems.³² There have also been null findings on emotion regulation and children's behavior toward the parent.³³

This result from the MIHOPE kindergarten follow-up highlights that home visiting can improve children's social-emotional functioning in the home environment, the context most proximal to where the intervention typically takes place. By working directly with parents and families, home visitors can offer forms of support that provide a critical foundation for children's lifelong development and learning. For instance, the child development literature indicates that children's social competence is associated with children's academic competence in school.³⁴ Further, learning to self-regulate attention and behavior is one of the major developmental milestones of early childhood and has substantial implications for educational opportunity and achievement. The ability to regulate emotion, control impulses, and maintain an optimal level of attention supports the goal-directed behavior necessary for the acquisition of new skills, knowledge, and overall academic learning.³⁵ Conversely, having behavior problems in early childhood, such as externalizing or internalizing symptoms, is a risk factor for mental health issues and academic difficulties throughout childhood and into adulthood.³⁶

The data used to measure the eight outcomes for these sub-areas were collected from multiple informants: children's caregivers via a caregiver survey, field interviewers' ratings during the in-home direct child assessment, and independent observers' ratings using a semi-structured play task conducted in the home.

Did Home Visiting Affect Children's Social-Emotional Functioning in School Settings?

MIHOPE found that home visiting did not have an overall statistically significant effect on children's social-emotional functioning in school settings. This conclusion is based on the results of the omnibus test conducted to answer this research question ($p = 0.105$), which collectively analyzed all nine outcomes in the three sub-areas shown in Figure 3.8: social skills, behavior problems, and emotional and behavioral self-regulation.³⁷ The nine individual

32. Chazan-Cohen, Raikes, and Vogel (2013); DuMont et al. (2010); Harden, Chazan-Cohen, Raikes, and Vogel (2012); Olds et al. (2004); Olds et al. (2014); Sidora-Arcoleo et al. (2010).

33. Chazan-Cohen, Raikes, and Vogel et al. (2013).

34. Cantor et al. (2019); Domitrovich, Durlak, Staley, and Weissberg (2017); Portilla et al. (2014).

35. Blair (2016).

36. Hinshaw (1992); Reef et al. (2011); Masten et al. (2005).

37. Details of estimated effects for outcomes that contribute to answering whether home visiting affected children's social-emotional functioning in school settings are shown in Appendix Table C.7.

Figure 3.8. Estimated Effects on Children’s Social-Emotional Functioning in School Settings at Kindergarten



SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: In this figure, positive results indicate favorable outcomes for families.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.105.

^aThe signs were changed for the effect sizes and confidence intervals of italicized outcomes so that positive results indicate favorable outcomes for children. For example, the direction of effects for the externalizing behaviors outcome was reversed; the positive estimated effect shown for externalizing behaviors indicates a favorable outcome for children (in other words, program group children experienced less externalizing behaviors than control group children).

effects were in a favorable direction and show a similar pattern as the effects for children's functioning in the home context. However, the effects have wider confidence intervals in Figure 3.8 relative to the effects in Figure 3.7, probably due to smaller samples sizes for the teacher survey, indicating that there was less precision to detect effects for outcomes collected from school settings. Collectively, the effects were not large enough to find an overall statistically significant and positive effect of home visiting on sub-areas related to children's social-emotional functioning in school settings.

MIHOPE provided an opportunity to understand whether the effects of home visiting on children's social-emotional functioning extended to school settings, a setting different from and more distal to where the intervention takes place. The transition to formal schooling entails a period when children shift from predominately interacting with parents and begin interacting with teachers and other children, while having considerable demands placed on them; kindergarteners need to form new relationships, communicate their needs appropriately, control their impulses, focus and pay attention, and engage with learning material.³⁸ In addition to capturing similar behaviors from the children's teachers as asked of caregivers, the sub-areas represented in this research question also capture children's learning behaviors and social skills that are often demonstrated in classroom settings, such as task orientation, frustration tolerance, cooperation, and assertive social skills. A growing body of research suggests that early positive learning behaviors are associated with children's academic skills.³⁹

Most studies of home visiting have not explicitly examined children's social-emotional functioning in school settings. While the overall result in the MIHOPE kindergarten follow-up was not statistically significant, MIHOPE does provide important information about children's functioning from teachers, who were not directly involved in home visiting. The data used to measure the nine outcomes from these sub-areas were collected from children's kindergarten (Cohorts 1, 2, and 4) and first grade (Cohort 3) teachers via a teacher survey (see Chapter 4 for more detail on how the COVID-19 pandemic affected the kindergarten follow-up).

Contextualizing Effects by Timing of Data Collection and Grade

As described earlier in this chapter, although the pandemic disrupted the MIHOPE kindergarten follow-up, the results analyzed and presented in this chapter pool data across the full sample as there were minimal differences in estimated effects across all outcomes when the sample was split based on the timing of data collection (pre-pandemic versus pandemic samples). To provide further context for interpreting this research question's main effects, this section discusses differences in estimated effects based both on the timing of data collection and grade level of the children because these two samples are conflated; 87.3 percent of the sample assessed after the onset of the pandemic were first graders while 12.7 percent were kindergarteners. Conversely, 99.5 percent of children in the pre-pandemic sample were kindergarteners. (See Appendices D and E.)

38. Rimm-Kaufman and Pianta (2000); Portilla et al. (2014).

39. Morris et al. (2014); Wagner and Ruch (2015).

Consistent with the overall finding about minimal differences in estimated effects based on the timing of data collection, no estimated effects were statistically significantly different for outcomes related to children’s social-emotional functioning in school settings when the sample was split based on timing of data collection (see Appendix D.7). However, when the sample was split by grade at follow-up, there were a few statistically significant differences in effects between the kindergarten and first-grade groups (see Appendix Table E.7). For outcomes where effects were significantly different, effects appear to be more favorable for kindergarteners than for first graders on outcomes in the emotional and behavioral self-regulation and social skills sub-areas. (This pattern of effects among the kindergarteners is similar to the pre-pandemic sample in Appendix D.7.)

These effects may be partially driven by differences in how teachers rated children on these scales in early 2022—the school context was different than before the pandemic onset and it is not possible to determine what the results would have been had all children been assessed at the same time point in their schooling. However, in the context of a randomized controlled trial, both the program and control group children experienced a shift in their schooling context. Since the findings for this research question largely show a similar pattern as the outcomes for children’s functioning in the home context (see Figure 3.7), these few differences based on children’s grade level do not appear to be driving the overall result.

Did Home Visiting Affect Children’s Cognitive, Language, and Early Math Skills?

MIHOPE found that home visiting did not have an overall statistically significant effect on children’s cognitive, language, and early math skills. This conclusion is based on the results of the omnibus test conducted to answer this research question ($p = 0.219$), which collectively analyzed all five outcomes in the three sub-areas shown in Figure 3.9: cognitive skills, language development, and mathematics development.⁴⁰

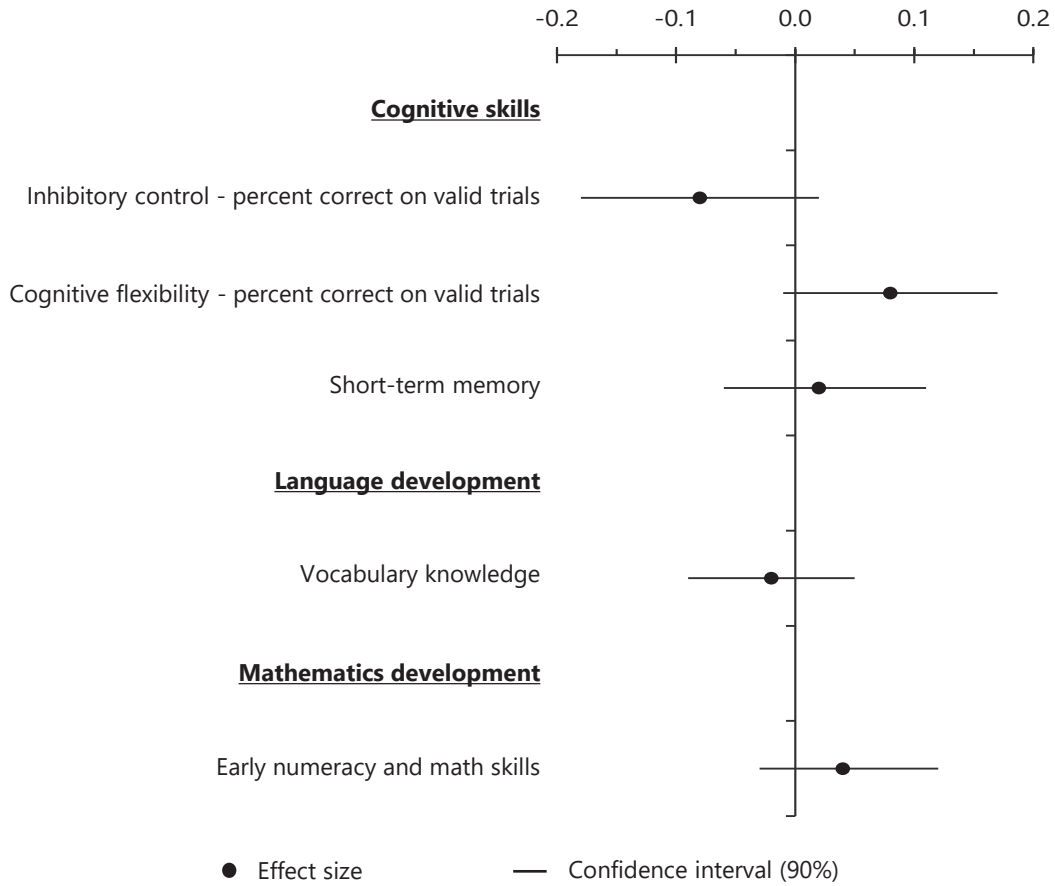
In an effort to collect information about children’s school readiness at the transition to kindergarten, MIHOPE assessed children’s cognitive, language, and math skills. Though the outcomes measured are more distal to the direct interactions and support the home visitor provides during visits, they are nurtured by early experiences in the home. Executive functions—the set of cognitive skills that enable children to control their attention, behavior, and emotions—have been implicated in school readiness and subsequent academic achievement and social competence.⁴¹ Parenting behaviors such as parental scaffolding, cognitive stimulation, sensitivity, and responsiveness are most consistently associated with individual differences in executive functions.⁴² Adversity and harsh parenting have been negatively

40. Details of estimated effects for outcomes that contribute to answering whether home visiting affected children’s cognitive, language, and early math are shown in Appendix Table C.8.

41. Obradović, Portilla, and Boyce (2012).

42. Fay-Stammach, Hawes, and Meredith (2014).

Figure 3.9. Estimated Effects on Children’s Cognitive, Language, and Early Math Skills at Kindergarten



SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: In this figure, positive results indicate favorable outcomes for families.
 An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.219.

associated with the development of executive functioning in children.⁴³ Yet, prior evaluations of the four models included in MIHOPE have not specifically examined these types of child cognitive skills. Since home visiting specifically focuses on encouraging the types of parenting practices that promote children’s executive functions and the 15-month follow-up saw early evidence of improvements in these areas, examining children’s executive functions at the school transition was of interest to study in MIHOPE.⁴⁴

43. Pechtel and Pizzagalli (2011).

44. Michalopoulos et al. (2019).

Similarly, children's language development is largely shaped by children's home environments and parental interactions.⁴⁵ Since maternal stimulation of children's language development is a core component of many home visiting programs, and past studies of home visiting evaluations when children were 5 to 7 years old have found intermediate impacts on language development,⁴⁶ MIHOPE examined children's vocabulary knowledge at the transition to formal schooling. Additionally, early math skills develop in diverse settings, such as in the home and informal out-of-school settings, and continue to strengthen in preschool and early elementary school.⁴⁷ While prior studies of home visiting have examined math outcomes in early elementary school and have not found effects,⁴⁸ MIHOPE sought a more holistic picture of children's school readiness at the outset of formal schooling and measured children's early math skills. The data used to measure the five outcomes from these sub-areas were collected directly from children during the in-home direct assessment. Although the kindergarten follow-up measured children's outcomes in a number of sub-areas, it was not feasible to include multiple measures of each sub-area in the in-home assessment. Future studies could provide additional measurement of children's skills in language or other areas to enhance understanding of whether home visiting has effects on these more distal cognitive and academic outcomes at the transition to formal schooling.

Contextualizing Effects by Timing of Data Collection and Grade

As noted above, the results analyzed and presented in this chapter pool data across the full sample, as there were minimal differences in estimated effects across all outcomes when the sample was split based on the timing of data collection (pre-pandemic versus pandemic samples). To provide further context for interpreting this research question's main effects, this section discusses differences in estimated effects based on the timing of data collection as well as the grade level of the children because these two samples are conflated; 87.3 percent of the sample assessed after the onset of the pandemic were first graders while 12.7 percent were kindergarteners. Conversely, 99.5 percent of children in the pre-pandemic sample were kindergarteners. (See Appendices D and E.)

When the sample was examined separately by timing of follow-up and by grade, the results indicate that the *levels and scores* were systematically higher for the pandemic sample than for the pre-pandemic sample, and for first graders than for kindergarteners. However, few effects were statistically significantly different and did not show a pattern of systematically more favorable *effects* for either group in either supplemental analysis. When the sample was split by timing of data collection at follow-up, there are three outcomes that had statistically significant differences in effects between the pre-pandemic and pandemic groups. Effects on early math skills were more favorable for the pre-pandemic sample than for the pandemic sample, while effects on inhibitory control were less favorable for the pre-pandemic sample than for the pandemic sample. Conversely, effects on vocabulary knowledge

45. Bann et al. (2016).

46. Drazen and Haust (1993); Olds et al. (2004).

47. Purpura and Napoli (2015); Civil and Bernier (2006).

48. Drazen and Haust (1993); Olds et al. (2004); Chazan-Cohen, Raikes, and Vogel (2013).

were less favorable among those assessed after the onset of the pandemic than for those in the pre-pandemic sample. (See Appendix Table D.8.) When the sample was split by grade, the impact on inhibitory control was less favorable for kindergarteners than first graders and the impact on early math skills was less favorable for first graders than kindergarteners. (See Appendix Table E.8.)

Because this study is a randomized controlled trial, and children in both the program and control groups experienced the pandemic's effects, the findings offer rigorous estimates of the effect of home visiting on children's cognitive, language, and early math skills. However, it is not possible to determine what the levels and scores would have been for this sample of children if these direct assessments had been collected during their kindergarten year in the absence of a pandemic. That the levels and scores were higher for the sample whose data were collected after the onset of the pandemic may simply be the result of children's developmental maturation in these particular sub-areas. While more research is warranted to further examine the effect of home visiting on these areas of children's development at the transition to schooling, these findings provide an important contribution to the home visiting literature given the limited evidence to date, as noted in Chapter 1.

ADDITIONAL ANALYSES

The study team conducted additional analyses to examine the effects of home visiting, which are explored in the appendices to this report. Exploratory analyses were conducted to understand whether the effects of home visiting are larger for some families than for others, using eight subgroups defined by family characteristics (see Appendix F).⁴⁹ Additional exploratory analyses included an examination of effects by evidence-based model (see Appendix H), and an examination using mediators measured at earlier waves to explore the mechanisms through which home visiting had effects on select individual outcomes at the kindergarten follow-up (see Appendix J).

CONCLUSION

This chapter presented the estimated effects of MIECHV-funded home visiting programs included in MIHOPE through the time children transitioned into formal schooling. The evidence suggests that mothers, families, and children who participated in home visiting are faring better five to seven years after study entry on a range of outcomes that align with the broad goals of the MIECHV Program. The favorable effects are concentrated on outcomes more proximal to and the focus of the home visiting interventions, namely those related to

49. The eight subgroups examined are defined by the following family characteristics: mother's level of psychological resources, mother's level of emotional functioning, presence of intimate partner violence between the mother and partner, mother's number of adverse childhood experiences, number of demographic risk factors experienced by mother's household, parity, focal child's gestational age at enrollment, and mother's race and ethnicity.

maternal well-being, parenting behaviors, and relational dynamics within the household. There is also a favorable effect on families' economic circumstances. Favorable effects also emerge for children at this kindergarten time point for more distal outcomes measured in a setting more closely tied to the intervention: children's social-emotional functioning in the home. There is less evidence to suggest that the longer-term effects of home visiting extend to other distal outcomes—children's social-emotional functioning in school settings or children's cognitive or academic outcomes—which are less closely tied to the home visiting intervention than children's social-emotional functioning in the home.

The next chapter discusses how the COVID-19 pandemic altered the study and the lives of the families in MIHOPE, as well as the study's investigations into the pandemic's implications for examining the effects of home visiting.

4

The Context of the COVID-19 Pandemic: Study Design Changes and Implications for Understanding the Effects of Home Visiting

The COVID-19 pandemic significantly affected the lives of families participating in MIHOPE and prompted changes in the study's data collection plans. The study pivoted and adapted to the new realities and uncertainty that emerged in March 2020 as the United States began to experience and respond to the COVID-19 pandemic to address two goals. The first goal was continuing to measure the longer-term effects of home visiting at the time the focal children transitioned to formal schooling (the primary goal of the kindergarten follow-up point). The second goal was understanding how MIHOPE families were experiencing the pandemic to contextualize findings about the effects of home visiting.

This chapter describes the study's pivots, adaptations, and additional data collection efforts, MIHOPE families' experiences during two time periods after the onset of the pandemic, and the study's investigations into the pandemic's implications for examining the effects of home visiting.

THE STUDY'S RESPONSE TO THE COVID-19 PANDEMIC

In March 2020, as public health emergency measures began to be put in place, the study team halted outreach to the few remaining Cohort 2 families who were still being invited to participate in data collection due to the risk in-person data collection presented to families and data collection staff.¹

1. As described in Chapter 2, data collection for Cohort 2 was fielded from September 2019 to April 2020. A national emergency was declared on March 13, 2020. Data collection with teachers continued until April 2020 since surveys were completed via the web or through paper versions that were mailed.

The original kindergarten design called for Cohort 3 data collection to occur during the 2020-2021 school year. However, in consultation with federal staff, the study team decided not to move forward with obtaining kindergarten follow-up data from families during that school year. Varying public health responses at the state and local levels complicated a uniform data collection approach given that families in MIHOPE live in many states across the country. Many locales were still under public health stay-at-home ordinances when the study team would have planned the logistics and hiring of data collection staff to launch Cohort 3's fielding effort as originally designed, and it was also unclear whether and how schools would reopen for the 2020-2021 school year.²

COVID-19-Focused Data Collection

Rather than collect Cohort 3 kindergarten follow-up data during the 2020-2021 school year, the study team implemented new virtual data collection efforts during this year to enhance understanding of how families in MIHOPE were experiencing the pandemic. These efforts were undertaken so that the study team would be in a position to contextualize the study's kindergarten findings, as the team anticipated resuming kindergarten data collection with the remainder of the study sample during the 2021-2022 school year. The study team administered a brief web survey to families in all cohorts in September and October 2020 and conducted qualitative interviews with a subsample of 102 families who responded to the web survey between October 2020 and January 2021.³ (See Figure 4.1.)

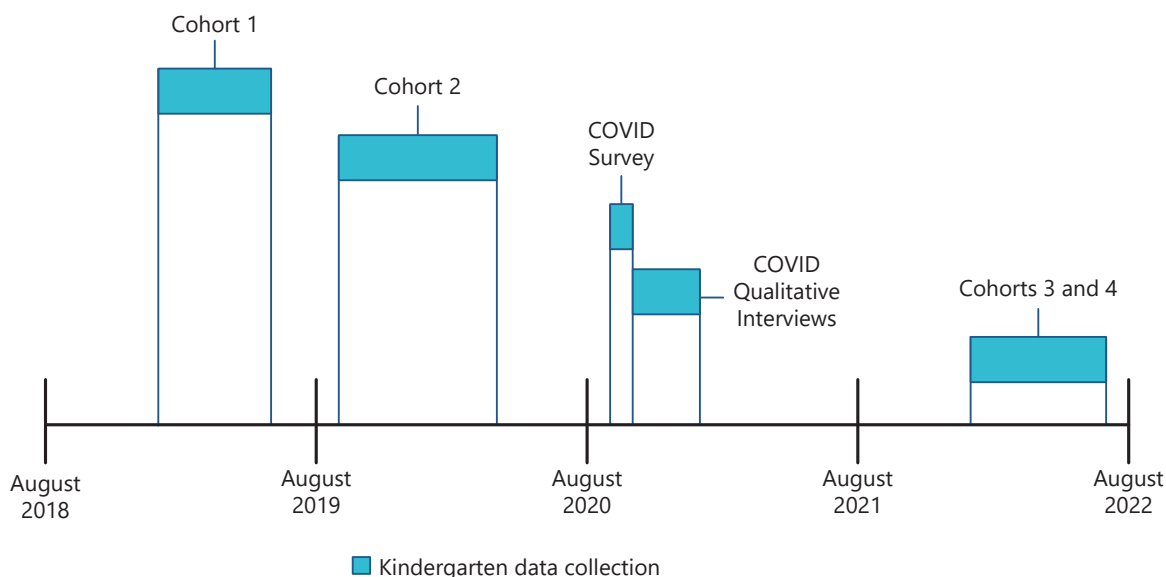
The web survey gathered a limited set of information about families' economic circumstances (employment, application for and access to public benefits and other supports, and experiences of food insecurity and material hardship); mothers' reports of their mental health and well-being (depressive symptoms, sense of mastery, and awareness of and ability to access resources); access to internet and technology; and their child's access to health care. The survey focused on economic and maternal well-being measures because these were areas that the pandemic appeared to be affecting and could be measured through a brief web survey. The specific measures of economic circumstances and mothers' reports of mental health and well-being were chosen to be consistent with measures that were included in the kindergarten data collection so that the study team could understand how families' experiences might be changing over time.⁴ In designing the brief survey, the study team balanced an interest in understanding families' experiences with an interest in minimizing data collection burdens for families.

2. Burbio (2022).

3. The web survey was fielded to 3,411 families, and 1,209 responded. A total of 790 families were not invited to participate in the web survey, for reasons such as the study team not having the family's email address on file or not having enough information about the MIHOPE child to administer the web survey because the mother was pregnant at study entry and had not participated in MIHOPE data collection since that point.

4. See Appendix A for measure descriptions.

Figure 4.1. MIHOPE Kindergarten Follow-Up and COVID Data Collection Timeline



NOTES: Data collection for Cohort 1 was fielded from January 2019 to June 2019. Data collection for Cohort 2 was fielded from September 2019 to April 2020. The COVID web survey was fielded to families in all cohorts in September and October 2020, and qualitative interviews were conducted with a subsample who responded to the web survey between October 2020 and January 2021. Data collection efforts for Cohorts 3 and 4 were fielded concurrently from January 2022 to July 2022 because of interruptions in the timeline due to the COVID-19 pandemic.

The qualitative interviews gathered in-depth information about families’ economic experiences and explored how parents and children were coping with the emotional impact of the pandemic, and how these experiences manifested in their relationships and interactions with each other. The interviews also gathered information about families’ experiences with school and child care, including remote learning.

To gather information about the 2020-2021 schooling experiences of children in Cohort 3, who were slated to attend kindergarten during this atypical school year, the study team added a series of questions to the caregiver survey that would be fielded when kindergarten data collection resumed.

Resumption of Kindergarten Data Collection

Resuming kindergarten data collection during the 2021-2022 school year presented the opportunity to continue to collect data from the children in Cohort 3 at their transition to formal schooling, since first grade was the first full year of consistent, in-person schooling for these children. In consultation with child development experts, the study team determined that it was developmentally appropriate to collect the study’s child functioning measures

when the children were in first grade. The study team hypothesized that there would not be large developmental differences between children in kindergarten and those who were in first grade during the 2021-2022 school year, in light of pandemic-related disruptions to children's kindergarten experiences during the 2020-2021 school year.⁵ As indicated in Chapter 2, rather than continue with in-person home assessments, the data collection protocol was adapted, and assessors were trained to deliver the child assessment and observation protocol virtually.

Kindergarten data collection resumed during the 2021-2022 school year. Data collection efforts for Cohorts 3 and 4 were fielded concurrently from January 2022 to July 2022, while children in Cohort 3 were attending first grade and children in Cohort 4 were attending kindergarten. Data collection staff delivered all the necessary equipment to families' homes, and helped connect them with the assessor who was off-site by joining a video conference call to launch the live virtual data collection protocol. Children were able to engage with and complete the virtual assessments, presumably because most had already completed a year of remote or hybrid schooling.⁶

MIHOPE FAMILIES' EXPERIENCES OF THE PANDEMIC

Through the new COVID-19-focused data collection efforts and the kindergarten data collection that resumed in 2022, the study team was able to learn about MIHOPE families' experiences at two time points after the onset of the pandemic.

At the time the study team began to plan for these COVID-19-focused data collection efforts in 2020, there was a great deal of uncertainty about how long the effects of the pandemic would persist. Even as the study team resumed kindergarten data collection in early 2022, it was not clear to what extent families' experiences at that point would be consistent with their experiences in late 2020 through early 2021. In retrospect, however, the data collected by the study team illustrates how the two time periods represent two distinct sets of experiences for MIHOPE families that occurred after the onset of the pandemic.

Late 2020 Through Early 2021: Closer to the Onset of the Pandemic

The 2020-2021 school year began approximately six months into the COVID-19 pandemic, at a time when the effects of the pandemic were still apparent across the country. Numerous

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5. Subsequent research supported the study team's hypothesis. For example, a study with 1.6 million students in the first and second grades found that children who entered first grade in the 2021-2022 school year (who had experienced only pandemic schooling) showed 6 to 7 percent lower growth in math and reading than their counterparts in a typical pre-pandemic year (Kuhfeld and Lewis, 2022).
 6. See Appendix I for additional information on the adaptation to an all-virtual data collection effort.

research efforts found that families were experiencing challenges as a result of the pandemic in terms of their mental health and economic circumstances, including food insecurity.⁷

Although the study team obtained only a brief snapshot of families' experiences through its 2020 web survey, the survey effort confirmed that consistent with national trends, MIHOPE families were experiencing high rates of depressive symptoms and food insecurity.⁸ Almost half of mothers reported experiencing depressive symptoms in fall 2020, compared to less than a quarter of mothers who reported experiencing depressive symptoms in the kindergarten data collection with Cohorts 1 and 2 that occurred before the pandemic. In interviews conducted in late 2020 and early 2021, most mothers reported feelings that aligned with depressive symptoms, including being afraid, anxious, or worried, or not being able to get going, an experience one mother described by saying:

There's... days where I'm, like, I don't even wanna get out of bed. Like, I don't wanna try because it just feels like it's gonna be failure all day again. But then most of the time, I feel like, "Okay, we're gonna get stuff done, you know. I'm gonna figure it out."

In fall 2020, about 43 percent of families surveyed reported experiencing food insecurity, compared with only about 20 percent who reported experiencing food insecurity in the pre-pandemic kindergarten data collection. Experiences of food insecurity were described by several mothers who participated in interviews in late 2020 and early 2021, who shared that they could not always afford to pay for food for their entire family, or access it through supports such as SNAP or food pantries. One mother described not having enough to eat while accessing multiple food pantries:

So like the one here in [state] used to only be able to go to every three months and now you can go to it every month [just once a month].... There's [another] one in [town] that I go to... [that] you can [visit] every week now or every other week.... I pretty much know what [resources are out] there. I mean, technically, I guess I could go to more food pantries and then I'd be able to eat more than once a day. But because I do way more, I don't necessarily need to eat more than once today right now. And there are other people that need it. There are probably some people that need it more than we do. So I try not to be too greedy.

As mothers of young children, the members of the MIHOPE sample were experiencing the pandemic's effects on their own well-being and their family's economic security, as well as contending with the pandemic's disruptions to their child's schooling and child care, which significantly affected their caregiving responsibilities.

7. Kalil, Mayer, and Shah (2020); Lamar, Speciale, Forbes, and Donovan (2021); Patrick et al. (2020).

8. The study team examined whether 2020 pandemic experiences were substantively different for MIHOPE families in the program group as compared to families in the control group and did not find evidence of substantive differences. See Appendix Table D.9.

In the 2020-2021 school year, states and local school districts implemented a heterogeneous set of reopening plans. Disruptions to the typical kindergarten experience included attending remote or hybrid (a combination of remote and in-person) schooling, staying in preschool an extra year (since many preschools stayed open while public schools remained closed for in-person schooling in some districts), or skipping kindergarten altogether.⁹ Children who attended kindergarten in person also did not have a typical kindergarten experience, as many experienced wearing masks or other face coverings and social distancing from their fellow students, as well as periods in which remote schooling was mandated for all students.

In the MIHOPE Cohort 3 sample, almost all children did attend kindergarten during the 2020-2021 school year. Only 3 percent of families reported that their child did not attend formal school, which is perhaps not surprising since other options were likely to be more accessible to families with more resources. Among the 97 percent of Cohort 3 children who attended kindergarten in 2020-2021, the following three instruction profiles emerged:

- *Only in-person instruction:* A little over one-fifth of children (22.9 percent) attended kindergarten in person, five days per week. On average, they were in school for eight months of the year, for about seven hours per day.
- *Only remote instruction:* Almost one-third of the children (29.5 percent) received kindergarten instruction remotely the entire school year. On average, they were in school for eight months of the year but only received live remote instruction from a teacher for about five hours per day.
- *Hybrid instruction:* The largest percentage of children (36.7 percent) received a mix of in-person and remote instruction. On average, caregivers reported that children received hybrid instruction for approximately six months of the year. During hybrid instruction, the children typically received an average of in-person instruction 3.4 days per week for about six hours per day and received an average of remote instruction 3.2 days per week for about four hours per day.¹⁰

An additional 11 percent of children received two or more modalities of instruction during their kindergarten year (for example, they began with only remote instruction and then transitioned to hybrid).¹¹

9. Dee, Huffaker, Phillips, and Sagara (2021).

10. Cohort 3 children's kindergarten experiences were reported retrospectively by caregivers on the 2022 caregiver survey; these numbers represent estimated averages based on caregiver's recollection about the prior school year and do not sum to a typical school day, week, or year.

11. No regions of the country are differentially represented in any of the three profiles. The children in the sample who received only in-person instruction lived in 20 states, children who received only remote instruction lived in 18 states, and children who received only hybrid instruction lived in 25 states, with overlap of states represented in each modality of instruction.

The realities of caring for children amidst the pandemic, including juggling remote or hybrid schooling, had implications for caregivers' own well-being, for their employment and economic security, and for their interactions with their children. While families spent more time together during lockdowns and other periods of school closures, providing opportunities for more connection, many caregivers had to juggle work, supporting remote schooling, and other caregiving and household responsibilities. The majority of mothers interviewed in late 2020 and early 2021 reported that it was stressful to be a parent at this time. One mother described how different parenting felt during the pandemic, saying:

[Being a parent has been] very hard, harder than it already was. It's just... there was just a lot of one-on-one that we weren't used to. And I know that sounds terrible. But we were all used to having our own time, and, you know, them in their own class, us working, you know, just that time away from each other. And I'm just... again, I know, that sounds terrible, but that was our life. And that was all turned upside down very quickly.

Pandemic lockdowns and disruptions to school and child care also had financial implications for families. The majority of mothers interviewed in late 2020 and early 2021 reported reductions in their income because at least one family member experienced job loss or a reduction in hours, and many mothers described having to leave or switch jobs to care for their children. Two mothers described experiences of having to leave their jobs because of the pandemic, saying:

[Before the pandemic,] life was very chaotic...in a good way. I was working 60 hours a week and raising both my kids alone, which sounds like a lot to most people, and it was, but the money that I was bringing into the household was very good, and we were financially in the best situation I had been in since I've been a mom.... And then [the pandemic started and] the kids couldn't go to school anymore. And... I don't have a lot of family, and the family I do have isn't very good at helping or has very busy lives themselves. So when that happened, I had to quit one of my jobs. And I had a small business I run, and I also worked at the post office part-time at night. And I had to give up my night job to be able to squeeze in time to homeschool, find daycare, and also be able to afford daycare now at this point, and try to homeschool and be a regular mom on top of, you know, doing my regular job....

Me and my fiancé... before 2020, we were doing really well.... We were making, like, \$25 an hour at this place, and getting good benefits, and all this stuff. And we were planning to stay there, join the union, like, learn the trade and love it, you know. I had to step away because of my daughter's school closing and going virtual. And I couldn't find steady daycare for her. The one babysitter I did have, like, she would keep bailing last minute and I was losing hours and I was getting [in trouble] at my job.... So I had to step away. I found a part-time job. And I work as a server on the weekends. So it's like completely working around her schedule and everything and [it's] just nights and on the weekends.

Caregivers who were able to work from home had little time left for one-on-one play and interactions with their children. As one mother described, she simply had to rely on screen time to get through all her tasks in a day:

[My kids] did a lot more screen time.... That was kind of a hard thing. Because I was like, “Well, I’m gonna get what I have to get done.” And... everyone’s coming out with, “Okay, here’s an idea for kids at home, and this for things at home.” And then it got to a point where it’s like, “Oh, I want to try to do all these things with my kids and try to like...” And then it was kind of a burnout of like, “Oh, I can’t do all of these things, and do work.” So I’d say like, oh, probably more screen time than I would have liked.... It kind of would fluctuate like, “Okay, if I have to do more work, you have to occupy yourself.”

The 2021-2022 School Year: Further from the Onset of the Pandemic

In contrast to the prior school year, the 2021-2022 school year began at a point further from the onset of the pandemic, when the initial period of uncertainty was in the past for most of the American population.

At this point in the pandemic, schools had generally reopened for in-person learning. While children experienced measures such as face coverings or social distancing in many schools, in-person schooling was a meaningful change for caregivers, who had fewer responsibilities to juggle each day. In contrast to the 23 percent of MIHOPE Cohort 3 children who attended school fully in-person in 2020-2021, 90 percent of children in Cohorts 3 and 4 attended in-person schooling in the 2021-2022 school year (91.6 percent of first graders and 85.1 percent of kindergartners). Approximately 4 percent received hybrid instruction while an additional 4 percent remained fully remote.

It was during this school year that direct kindergarten data collection for Cohorts 3 and 4 occurred, from January 2022 to July 2022. Using the 2022 kindergarten data, the study team investigated whether heightened levels of stressors seen in 2020 and early 2021 had persisted into 2022, and found that for the vast majority of kindergarten outcomes, levels were similar for families and children in the pre-pandemic sample and in the pandemic sample (see Appendix D). Heightened levels of depressive symptoms and food insecurity were no longer present.

Instead, the percentage of mothers who reported experiencing depressive symptoms in the pandemic kindergarten data collection was similar to the percentage of mothers who had reported experiencing depressive symptoms pre-pandemic (about 23 percent).

Similarly, and in contrast to heightened levels of food insecurity seen in 2020-2021, the percentage of families experiencing food insecurity in 2022 was about 19 percent—about half the rate seen closer to the onset of the pandemic. In fact, for a cluster of five economic outcomes, levels for families (in both the program and control groups) appear systematically

more positive for the pandemic sample as compared with the pre-pandemic sample.¹² The pattern for these five outcomes (household income, earnings, food insecurity, number of hardships, and number of moves) is not surprising, given the COVID-era economic supports that were available to families into 2022. These included economic income payments, also referred to as stimulus checks, expanded unemployment insurance, increases in and the expansion of the Child Tax Credit, and increases in SNAP benefits.¹³

It appears that delaying data collection until 2022 meant that families' experiences measured through outcomes included in the MIHOPE kindergarten analysis were similar to families' experiences prior to the pandemic. These findings suggest that the influence of the pandemic on measures included in the kindergarten analysis was not readily apparent, although the influence of the pandemic may have lingered in ways that the study team did not measure.

INVESTIGATING THE INFLUENCE OF THE PANDEMIC ON THE EFFECTS OF HOME VISITING

As described above and in Chapter 3, the primary goal of the MIHOPE kindergarten follow-up is to examine the longer-term effects of home visiting at the transition to formal schooling.

To decide whether the kindergarten analysis should focus on effects for the full sample or whether it was more appropriate to focus on the effects of home visiting separately for the pre-pandemic sample and pandemic sample, differences in effects between the two groups were examined. MIHOPE found that in general, effects did not differ based on whether data was collected before the pandemic or almost two years after the onset of the pandemic.¹⁴ The impacts of home visiting are similar for families at both time points. Therefore, the estimated effects presented in Chapter 3 are shown for the full sample.¹⁵

Although the impacts of home visiting were generally similar at both data collection time points, there were a few outcomes with differences: estimated effects are statistically significantly different between the two time points for 6 of the 60 outcomes that contribute

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12. Other differences between levels for the pre-pandemic and pandemic samples appear to be related to the age of children at assessment, rather than the timing of data collection. Children assessed during the pandemic scored higher on tasks measuring their cognitive, language, and early math skills as compared to children assessed prior to the pandemic. These findings are likely due to maturation and developmental progression of these skills in older children, as evidenced by the greater number of first graders in the sample assessed in the pandemic sample.
 13. Gelman and Stephens (2022); Raifman, Bor, and Venkataramani (2021); U.S. Department of the Treasury (n.d.); U.S. Department of Agriculture (2023).
 14. See Appendix D for differences in effects based on timing of data collection.
 15. Discussion of how the timing of data collection, including children's grade at follow-up, may have influenced the findings for topical research question results is included in Chapter 3.

to answering topical research questions.¹⁶ Although these differences in effects may have occurred due to chance, the study team analyzed whether results are consistent with findings from other studies and reporting about the pandemic's influence for three of these individual outcomes.¹⁷ These three outcomes, listed with the research questions to which they contribute, are: (1) illicit drug use (maternal mental and behavioral health); (2) substantiated report of abuse (family conflict, intimate partner violence, aggression, and child maltreatment); and (3) emotional self-control (children's social-emotional functioning in the home). The three other outcomes for which effects were significantly different between the data collection time points measure children's cognitive, language, and early math skills. These child outcomes are referenced in Chapter 3, in the discussion of how timing of data collection and children's grade at follow-up may have influenced effects.

The estimated effect for *use of illicit drugs* was statistically significant and in a favorable direction for the pre-pandemic sample, meaning illicit drug use was lower on average for the program group than the control group. It was not statistically significant and in an unfavorable direction for the pandemic sample, meaning illicit drug use was higher on average for the program group than the control group. This difference may have occurred due to chance, but it is also possible that the incongruent estimated effect for the later sample could be related to the lingering effects of the pandemic. Nationally, drug use increased in 2020 but decreased by 2021, a decrease that was sustained through 2022.¹⁸ COVID-related drug use, however, may have attenuated the effects of home visiting when the MIHOPE kindergarten data collection resumed in 2022. Consistent with national trends, the percentage of mothers who reported illicit drug use was similar in the MIHOPE pre-pandemic and pandemic samples (approximately 7 to 8 percent of mothers reported illicit drug use).

The estimated effect for *substantiated report of child abuse* was statistically significant and in a favorable direction for the pre-pandemic sample. For the pandemic sample, the effect was statistically significant and in an unfavorable direction. However, the overall low incidence of abuse within the MIHOPE sample (less than 1 percent of the sample overall experienced abuse) and the measurement of this outcome using data that encompassed multiple pre-pandemic years for both samples suggests that this difference in effects across time periods could be due to chance rather than being related to the timing of data collection.

For the children's *emotional self-control in the home* outcome, the estimated effect was also statistically significant and in a favorable direction for children in the pre-pandemic sample and statistically significant and in an unfavorable direction for children in the pandemic sample. Although emotional self-control is the only one of three outcomes in the emotional and behavioral self-regulation sub-area for which effects significantly differ based on the

16. Although the analytic strategy used in this report focuses on effects for groups of outcomes that collectively contribute to topical research questions, this investigation of differences in effects based on the timing of data collection highlights individual outcomes.

17. If there were no actual differences in effects 10 percent of the tests (6 of 60) could be statistically significant based on sampling error alone.

18. National Institute on Drug Abuse (2023).

timing of data collection, stressors from the pandemic may have influenced the effect of home visiting on children's emotional self-control, consistent with evidence on the negative effects of the pandemic on children's behavioral health.¹⁹

CONCLUSION

MIHOPE families' experiences closer to the onset of the pandemic were characterized by heightened levels of depressive symptoms and food insecurity, as well as stress related to school closures and other pandemic-related uncertainties and disruptions. Caring for a child during this period was challenging. These challenges were experienced by families in both the program and control groups. Later after the onset of the pandemic, after schools had more consistently reopened for in-person learning and data collection resumed in early 2022, the heightened levels of depressive symptoms and food insecurity were less apparent. In investigating the pandemic's implications for examining the effects of home visiting, the study team found that in general, the effects of home visiting did not differ based on the timing of data collection. This finding does not diminish the challenges and difficulties families confronted earlier in the pandemic, the effects of which may have persisted in ways MIHOPE did not measure.

19. Hanno et al. (2022).

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Considerations for Future Research

Since 2010, there has been considerable investment in the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program,¹ with reauthorization extending funding for the program through 2027.² These investments have expanded the availability of evidence-based home visiting programs throughout the country, reaching families at a key period in their children’s early development. This report represents the next installment in understanding the effects of early childhood home visiting on families who participated in the Mother and Infant Home Visiting Program Evaluation (MIHOPE). It expands the existing evidence base by comprehensively measuring how families and children were faring around the time children transitioned to formal schooling, five to seven years after initially enrolling in the study and expressing interest in home visiting services.

The MIHOPE kindergarten follow-up expands the existing knowledge base in important ways. The study provides information on a broad set of families, since local programs that participated in MIHOPE operated in 12 different states. The number of families in the study is also larger than in previous longer-term studies, which typically had relatively small samples, providing better precision in estimating longer-term effects of home visiting. Previous long-term studies were model-specific and did not examine the same outcomes in the same way across models, making it difficult to summarize across studies and models. MIHOPE measured the same outcomes for all four evidence-based models: Early Head Start—Home-based option, Health Families America, Nurse-Family Partnership, and Parents as Teachers. Notably, the prior evidence of intermediate effects for these four models is a few decades old. Home visiting programs have evolved since then due to statutory requirements of the MIECHV Program and ongoing quality improvement efforts by programs and models. While home visiting programs have continued to evolve and improve through advances in knowledge and dedicated quality improvement efforts by programs and models, this report

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1. SEC. 511[42 U.S.C. 711] (j) (1).
 2. Funds for subsequent fiscal years were appropriated by section 209 of the Protecting Access to Medicare Act of 2014, Pub. L. 113-93 (fiscal year 2015); section 218 of the Medicare Access and Children’s Health Insurance Program Reauthorization Act of 2015, Pub. L. 114-10 (fiscal years 2016-2017); section 50601 of the Bipartisan Budget Act of 2018, Pub. L. 115-123 (fiscal years 2018-2022); and section 6101 of the Consolidated Appropriations Act of 2023 Pub. L. 117-328 (fiscal years 2023-2027).

provides a more current examination of the intermediate effects at the kindergarten time point than the prior evidence for each of these four models. This chapter summarizes these findings and offers the field some considerations for future research.

ANALYZING GROUPS OF OUTCOMES

Early childhood home visiting programs are designed to affect a wide range of maternal, family, and child outcomes across multiple areas, and by law, MIECHV-funded programs must work toward demonstrating improvements in at least four of six benchmark areas.³ Because home visiting programs address a broad range of outcomes, MIHOPE examined the effectiveness of home visiting across groups of outcomes organized into eight pre-specified topical research questions. In this way, the MIHOPE kindergarten analysis also differs from prior studies of home visiting, which have focused on individual outcomes. The approach of analyzing more comprehensive research questions about child and family functioning may be well-suited to studying home visiting because programs as a whole are trying to affect a wide range of outcomes. The broad and tailored nature of home visiting services may mean that home visiting is helping each family in some way, so effects may be spread across many outcomes even though the average effect on any single outcome might be small.

ESTIMATED EFFECTS OF HOME VISITING ON MATERNAL, FAMILY, AND CHILD WELL-BEING

The research questions examined in Chapter 3 were motivated by the MIECHV benchmarks, the logic models from the four evidence-based home visiting models included in MIHOPE, and earlier MIHOPE evidence. By anchoring the analysis to topical research questions, the analysis was able to examine a throughline from more proximal outcomes in the logic models from these evidence-based home visiting models to more distal outcomes and settings. Home visitors first and foremost work with mothers to support and create behavior change for the mother based on her strengths and interests. This work carries into other areas of the family system targeted by home visiting, such as interactions with children and other family members. In this way, home visiting aims to address more proximal outcomes at the maternal and family levels, with an aim that these positive outcomes will extend more distally to children's functioning as they grow and develop.

MIHOPE found favorable effects of home visiting for all five research questions that address outcomes more proximal to the intervention. This indicates that home visiting was effective at improving maternal coping strategies and parenting behaviors that are directly targeted via interactions with home visitors in the home; maternal mental and behavioral health;

3. SEC. 511 [42 U.S.C. 711] (h) (3) (A), as amended by section 6101 of the Consolidated Appropriations Act, 2023 (P.L. 117-328).

parent-child interactions; a constellation of outcomes related to conflict, violence, aggression, and maltreatment; and families' economic circumstances. Though the effects on the individual outcomes were small, collectively the results for these five research questions indicate that the MIECHV-funded home visiting programs included in MIHOPE demonstrated improvements in the benchmark areas specified in the legislation that authorized the MIECHV Program.⁴ This further emphasizes the potential value of using groups of outcomes in future studies to interpret and understand effects across the many areas of family functioning that home visiting programs address.

The favorable results related to parenting and maternal and family well-being at the transition to formal schooling continue to build the MIHOPE evidence base from earlier follow-ups that home visiting has small but positive impacts across a broad range of outcome areas.⁵ However, a key motivation for examining the effects of home visiting at this time point was to determine if the early improvements seen in MIHOPE in maternal and family functioning outcomes would produce impacts on child functioning as children transitioned into formal schooling. Kindergarten is widely considered a sensitive developmental period for later school success. Children's behavior and self-regulation at the start of kindergarten have been shown to affect the dynamic of teacher-child relationships and child outcomes such as social competence, school engagement, math and reading achievement, and behavior problems.⁶ Children's reading and math scores in kindergarten have also been strongly correlated with later individual earnings and educational outcomes such as college attendance, such that improvements in children's reading and math skills in kindergarten have the potential to lead to increases in earnings and improvements in educational outcomes.⁷

As seen in Chapter 3, favorable effects of home visiting did emerge for more distal child outcomes that were measured in the setting where the intervention took place—children's social-emotional functioning in the home. This research question included measurement of children's social skills, behavior problems, emotional and behavioral self-regulation, and behavior towards their parents during the semi-structured task. And while the magnitude of effects was not strong enough to confirm a favorable effect on similar behaviors in a more distal classroom setting, the general pattern is the same. However, there is less evidence to suggest that there are longer-term effects of home visiting on outcomes *most* distal to the intervention: children's cognitive and academic outcomes.

4. SEC. 511 [42 U.S.C. 711] (d) (1) (A) (i-vi); SEC 511 [42 U.S.C. 711] (d) (2) (B) (i-vii).

5. Michalopoulos et al. (2019); Faucetta, Michalopoulos, Portilla, and Saunders (2023).

6. Myers and Morris (2009); Rudasill and Rimm-Kaufman (2009); Portilla et al. (2014); Duncan et al. (2007); Eisenberg, Valiente, and Eggum (2010).

7. Chetty et al. (2011).

IMPLICATIONS FOR FUTURE MEASUREMENT

Though the estimated effects suggest that home visiting has impacts on more proximal outcomes, the nonsignificant finding when examining the effects of home visiting on children's cognitive, language, and math skills may warrant further exploration. This research question grouped together academic skills and goal-oriented cognitive skills that are implicated in those academic skills. All outcomes were measured using direct child assessments, which is the gold standard in assessment research. However, it is possible that more robust measurement is needed (for instance, measuring more outcomes within a sub-area or from multiple informants or modalities) to precisely and comprehensively estimate the effects of these more distal outcomes that are not the central focus of home visiting programs. Future studies could aim to fill this gap in the evidence by including more comprehensive measurement of language and other skills in these sub-areas to further understanding of children's school readiness at the transition to formal schooling.

LOOKING AHEAD

This report continues to advance understanding of the effects of early childhood home visiting programs on families who participated in MIHOPE. Given the positive effects found in prior long-term studies of home visiting, the next MIHOPE follow-up will examine the effects of home visiting through the time children are in third grade and will include a benefit-cost analysis that will examine whether the benefits of home visiting outweigh the costs once children are in elementary school.

APPENDIX

A

Measure Descriptions

This appendix describes the outcome measures and subgroup definitions used in the report. Outcomes are presented first and are organized by outcome area as follows: (1) parenting, (2) maternal well-being, (3) family conflict and violence, (4) family economic circumstances, (5) child functioning, and (6) other outcomes. Outcomes within each area are further organized by sub-area (refer to Table 2.2 for the order). Subgroup definitions are presented last.

All outcomes used in this report are derived from one or more of the following sources: (1) caregiver survey, (2) direct assessments, (3) teacher survey, (4) administrative records, or (5) the COVID-19 survey. Some outcomes derived from the caregiver survey are constructed from items that were a part of the survey planned missingness design. For items in this survey design, only two-thirds of caregivers were asked to respond to reduce burden on families. Missing data due to the planned missingness design as well as item-level nonresponse on these survey items were imputed for families who responded to the caregiver survey but did not respond to these items. As described later, some measures were imputed using other data collected at kindergarten, and some measures were imputed using data collected at kindergarten and select baseline characteristics. For measures that were not part of the planned missingness design, the study team made decisions about how to account for item missingness when constructing outcomes, unless otherwise stated in the outcome description.

For Cohorts 1 and 2, if the focal child (the child for whom the mother enrolled in home visiting) was not in kindergarten or first grade at the time of data collection, the family was not eligible for the caregiver survey, the direct assessments, or the teacher survey. Given the delayed data collection period for Cohorts 3 and 4, eligibility for the caregiver survey was expanded to include families where the focal child was in second grade at the time of data collection. For the 23 families who responded to the caregiver survey saying the focal child was in second grade, the analysis included these families on maternal well-being outcomes, select family conflict and violence outcomes, and family economic circumstances outcomes but did not include these families on child functioning and parenting outcomes. Eligibility was not expanded for the direct assessments or the teacher survey, given that these fielding efforts focused on collecting child functioning and parenting outcomes.¹

For families where the mother was not available to answer the caregiver survey or participate in the direct assessments (in most cases because she no longer had custody of the child), the child's new caregiver responded to the caregiver survey or participated in the direct assessments. The analysis included these caregivers on child functioning outcomes but did not include these caregivers on parenting, maternal well-being, family conflict and violence, or family economic circumstances outcomes. For 94 families, the child's new care-

1. Second graders are more developmentally advanced than kindergarteners and first graders on a number of developmental and learning domains, such as language and self-regulation. Additionally, both kindergarten and first grade have a curricular emphasis on basic and foundational language, literacy, and math skills, whereas second graders are typically expected to have progressed to more complex concepts, better self-regulation, and greater independence in their learning. For these reasons, the analysis on child functioning and parenting outcomes were limited to only kindergarteners and first graders, since kindergarten was the focus of this follow-up. The study team did not expect to see differences in other maternal- or family-focused outcomes based on child age.

giver responded to the caregiver survey. For 100 families, the child's new caregiver participated in the direct assessments.

PARENTING

Parent-Child Relationship

Parental warmth is conceptually derived from the Early Childhood Home Observation for Measurement of the Environment (EC-HOME),² which is the most commonly used measure of the home environment in prior home visiting evaluations. The items focus on the amount of affection and responsiveness between the caregiver and child, such as whether the caregiver praises the child and whether the caregiver's voice conveys positive feelings about the child. The outcome was measured through different data collection efforts for Cohort 1 and Cohorts 2 through 4. For Cohort 1, seven items were administered as part of the direct assessments through observations conducted by trained field interviewers; one item was administered as part of the caregiver survey (which asked mothers whether they encourage their child to talk and take time to listen). For Cohorts 2 through 4, all eight items were administered as part of the direct assessments through observations conducted by the interviewers. The measure is equal to the mean of the items present multiplied by the total number of items in the subscale. For Cohort 1, if someone other than the child's biological mother responded to the caregiver survey, the family is missing on this outcome. For all cohorts, if someone other than the child's biological mother participated in the direct assessments, the family is missing on this outcome. If more than one item is missing, the family is missing on this outcome. Scores range from 0 to 40 with a higher score indicating higher levels of parental warmth.

Parent-child dysfunctional interaction assesses the extent to which the mother perceives the child as not meeting expectations and finds that interactions with the child are not reinforcing her parenting role. This outcome is measured using six items from an adapted version of the Parenting Stress Index—Short Form,³ which was distributed as part of the caregiver survey. Items ask about whether the mother's interactions with the child line up with expectations and whether the mother perceives the child to be distant or cruel to them. Response options range from 1, indicating the mother strongly agrees with the statement, to 5, indicating the mother strongly disagrees with the statement. Parent-child dysfunctional interaction is equal to the sum of the six items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the survey or if the mother reported the child was not

2. For the EC-Home, see Caldwell and Bradley (2003). Two additional items from the EC-HOME were used in order to create a conceptually derived parental warmth subscale, which has been shown to demonstrate moderate to high reliability and adequate predictive validity across five large-scale data sets (Leventhal, Martin, and Brooks-Gunn, 2004).

3. Whiteside-Mansell et al. (2007).

in kindergarten or first grade, the family is missing on this outcome. Scores range from 6 to 30 with higher values indicating greater levels of parent-child dysfunction.

Behavior Toward Child During Semi-Structured Task

Outcomes within this sub-area were assessed during the Three-Bag Task, a semi-structured play interaction administered as part of the direct assessments. The mother and child were given three bags of interesting toys and asked to play with the toys in sequence for 10 minutes. The interaction was video-recorded, and the mother's and child's behaviors were coded by child development researchers at the National Center for Children and Families at Teachers College, Columbia University using a strict coding protocol.⁴ This assessment, used in the 15-month follow-up, was originally adapted for this evaluation from the Three-Bag Task coding scheme used at 14 months in the Early Head Start Research and Evaluation Project.⁵ The version of the assessment used in the 15-month follow-up was further adapted by the study team for the kindergarten follow-up to make the interaction suitable for older children. If someone other than the child's biological mother participated in the interaction, the child is missing on these outcomes. If someone other than the child's biological mother participated in the interaction, the family is missing on these outcomes.

Parental sensitivity measures how the mother observes and responds to the child's cues (gestures, expressions, and signals) during times of distress as well as non-distress. Sensitive parenting involves tuning in to the child and manifesting awareness of the child's needs, moods, interests, and capabilities. Values range from 1 to 7 with higher values indicating greater levels of parental sensitivity.

Parental positive regard taps the mother's expression of love, respect, and/or admiration for the child. Positive regard is evidenced in the way(s) in which the mother listens, watches attentively, and looks into the child's face when talking to the child. Values range from 1 to 7 with higher values indicating greater levels of parental positive regard.

Parental stimulation of cognitive development focuses on the mother's effortful teaching to enhance perceptual, cognitive, and linguistic development. Stimulation of cognitive development encompasses clear guidance, scaffolding, and verbal stimulation. Values range from 1 to 7 with higher values indicating greater levels of parental stimulation of cognitive development.

Parental intrusiveness reflects the degree to which the mother exerts control over the child rather than acting in a way that recognizes and respects the validity of the child's perspective during semi-structured play. Values range from 1 to 7 with higher values indicating greater levels of parental intrusiveness.

4. Morin and Brooks-Gunn (2018).

5. U.S. Department of Health and Human Services, Administration for Children and Families, Office of Planning, Research, and Evaluation (1996-2010).

Parental detachment measures the mother’s lack of awareness, attention, and/or engagement with the child. Parental detachment includes both the extent to which the mother interacts with the child (e.g., quantity of interaction) and the way in which the mother interacts with the child (e.g., quality of interaction) during semi-structured play. Values range from 1 to 7 with higher values indicating greater levels of parental detachment.

Parental negative regard reflects the mother’s expression of discontent with, anger toward, disapproval of, and/or rejection of the child during semi-structured play. Values range from 1 to 7 with higher values indicating greater levels of parental negative regard.

Aggression Toward Child

Frequency of psychological aggression during the past year assesses the frequency of behaviors such as yelling, screaming, or swearing at the child or calling the child names in the past year. This outcome is measured using five items from the psychological aggression subscale of the Conflict Tactics Scales: Parent-Child Version (CTS-PC),⁶ which was administered as part of the caregiver survey. Items ask about whether the mother has raised her voice at the child, threatened physical punishment, or otherwise insulted or directed profanity toward the child. Responses range from 0 (indicating she never performed the behavior in the past year) to 8 (indicating she performed the behavior six or more times in the past year). Frequency of psychological aggression is equal to the sum of the five items. If someone other than the biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome. If the mother did not respond to any of the psychological aggression items, the family is missing on this outcome. Scores range from 0 to 40, with higher values indicating greater frequencies of psychological aggression.

Frequency of physical aggression during the past year indicates whether the mother engaged in any acts of severe or very severe physical aggression with the focal child in the past year. This outcome is measured using three items from the severe physical assault subscale of the CTS-PC,⁷ which was administered as part of the caregiver survey. Items ask about whether the mother hit the child forcefully or using household objects. Responses range from 0 (indicating she never performed the behavior in the past year) to 8 (indicating she performed the item six or more times in the past year). If the mother reported that she engaged in physical aggression toward the child at least once in the past year, then she is considered to have engaged in severe or very severe physical aggression with the focal child. If the mother reported that she never engaged in physical aggression toward the child in the past year, then she is not considered to have engaged in severe or very severe physical aggression. If someone other than the biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing

6. For the CTSPC, see Straus, Hamby, and Warren (2003).

7. Straus, Hamby, and Warren (2003).

on this outcome. If the mother did not respond to any of the physical aggression items, the family is missing on this outcome.

Child Maltreatment

Any substantiated report of abuse since 15 months indicates whether there have been any substantiated reports of abuse toward the focal child by any perpetrator between the date the child turned 15 months old (maltreatment reports at the 15-month follow-up point were measured through the time the focal child turned 15 months old) and the end of the child's kindergarten (or projected kindergarten) year.⁸ A substantiated report refers to a report that was submitted to the child welfare department of a given state, was investigated, and was deemed to be a legitimate report of abuse. This outcome is measured using state administrative child welfare records. If there was a substantiated report of abuse where the focal child was the victim between the date the child turned 15 months old and July 31 of the child's kindergarten year, then the family is considered to have a substantiated report of abuse. If the family did not have a substantiated report of abuse where the focal child was the victim or if the family did not match to the state administrative child welfare records, then the family is considered to not have a substantiated report of abuse. If the family did not match to state administrative child welfare records due to a lack of identifiers, if the family enrolled in the study in a state in which the study team did not receive data, or if a report of abuse was still open with no other substantiated reports of abuse found, the family is missing on this outcome.

Any substantiated report of neglect since 15 months indicates whether there have been any substantiated reports of neglect toward the focal child by any perpetrator between the date the child turned 15 months old (maltreatment reports at the 15-month follow-up point were measured through the time the focal child turned 15 months old) and the end of the child's kindergarten (or projected kindergarten) year. A substantiated report refers to a report that was submitted to the child welfare department of a given state, was investigated, and was deemed to be a legitimate report of neglect. This outcome is measured using state administrative child welfare records. If there was a substantiated report of neglect where the focal child was the victim, between the date the child turned 15 months old and July 31 of the child's kindergarten year, then the family is considered to have a substantiated report of neglect. If the family did not have a substantiated report of neglect where the focal child was the victim or if the family did not match to the state administrative child welfare records, then the family is considered to not have a substantiated report of neglect. If the family did not match to state administrative child welfare records due to a lack of identifiers, if the family enrolled in the study in a state in which the study team did not receive data, or if a report

8. If the family completed the caregiver survey or direct assessments or if a teacher completed the teacher survey, the grade reported through these data collection efforts was used to determine the child's kindergarten year. If the family did not have a completed caregiver survey, direct assessment, or teacher survey, then the study team assumed the child was in kindergarten the year of data collection if the child was in Cohorts 1, 2, or 4 and the year before data collection if the child was in cohort 3. See Chapter 2 for more information on the delays in data collection for cohort 3.

of abuse was still open with no other substantiated reports of neglect found, the family is missing on this outcome.

Any hospitalizations for injuries or ingestions since 15 months indicates whether the focal child has been hospitalized for an injury or ingestion between the date the child turned 15 months old (healthcare encounters for injury or ingestion at the 15-month follow-up point were measured through the time the focal child turned 15 months old) through December of the child's kindergarten (or projected kindergarten) year. This outcome is measured using Medicaid-paid inpatient claims data from the Research Data Assistance Center on behalf of the Centers for Medicare and Medicaid Services. If the child was hospitalized with an injury or ingestion diagnosis code, the child is considered to have a hospitalization for injuries or ingestions. If the child was never hospitalized with an injury or ingestion diagnosis code or did not match to the Medicaid data, the child is considered to not have a hospitalization for injuries or ingestions. If the child did not match to the Medicaid data given a lack of identifiers, the child is missing on this outcome. Due to lags in data availability, children in Cohort 4 are missing on this outcome.

Parental Support for Learning and Development

Reads to child daily indicates whether the child is read to daily in a typical week by either the mother or a member of the family. This outcome is drawn from one item from the caregiver survey. The item asks, "In a typical week, how often do you or any other family members read books to the child?" Response options range from 1 indicating that the mother (or a family member) does not read to her child at all in a typical week, to 4, indicating that the mother (or a family member) reads to her child seven days a week in a typical week. If the mother responded with 4, indicating that the mother reads to her child daily, then she is considered to have read to her child daily. If the mother responded with less than 4, then she is not considered to have read to her child daily. If someone other than the child's biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome.

Average amount of reading to child per day in a typical week indicates the average number of minutes the mother or a family member read to the child per day in the past week. This outcome is presented in minutes and drawn from two items from the caregiver survey. Items ask, "In a typical week, how often do you or any other family members read books to the child?" and "Generally, for about how many minutes is the child read to at each of these times?" If the mother indicates that she or a family member read to the child for zero minutes a day or that she did not read to the child in the past week, the average time is set to zero minutes. If the mother indicated that she or a family member read to the child at least once in the past week, the outcome is equal to the number of minutes reported when asked for how many minutes the child is read to. If someone other than the child's biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome. If the mother did not report on the frequency of reading sessions or if the mother did not report the average number of minutes

read to the child but indicated the child was read to at least once, the family is missing on this outcome. Values range from 0 to 120 minutes.

Number of children’s books in the home represents the number of children’s books, including library books, in the home at the time of the caregiver survey. The measure is based on one item from the caregiver survey asking, “About how many children’s books are in your home now, including library books?” This measure is equal to the response given and ranges from 0 to 500 books. If someone other than the child’s biological mother or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome.

Composite of in-home literacy activities measures the frequency and number of literacy activities in which the mother or other family members engage the child in a typical week. It is based on four items from the caregiver survey, asking how often the mother or other family members read books to the child, how often the child looks at picture books outside of school, how often the child reads to or pretends to read to himself or herself or to others outside of school, and how often the mother or other family members tell stories to the child. To create the composite, each of the in-home literacy activities is first dichotomized based on whether the mother or other family members engaged with the child in the activity three or more times a week.⁹ The composite is then calculated by taking the mean of the four dichotomized items. These items were part of the planned missingness design of the caregiver survey. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child’s biological mother completed the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome. Scores range from 0 to 1 with higher values indicating a higher frequency and number of literacy activities completed in the home.

Composite of in-home learning activities measures the frequency of and number of learning activities in which the mother or other family members engage the child in a typical week. It is based on nine items drawn from the caregiver survey, asking if the mother engages the child in various activities like singing songs with the child, playing games or doing puzzles, and doing writing activities with the child. To create the composite, each of the in-home learning activities is first dichotomized based on whether the mother or other family members engaged with the child in the activity three or more times a week.¹⁰ The composite is then calculated by taking the mean of the nine dichotomized items. These items were part of the planned missingness design of the caregiver survey. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child’s biological mother completed the survey or if the mother reported the child was not in kindergarten or

9. Bassok et al. (2016).

10. Bassok et al. (2016).

first grade, the family is missing on this outcome. Scores range from 0 to 1 with higher values indicating a higher frequency and number of learning activities completed in the home.

Percentage of days absent from school assesses the percentage of days the focal child was absent during the school year in which direct data collection was fielded. This outcome is measured using state- and district-level school records data. If the child did not match to the school records data or if the child matched to school records but school records indicated the child was not in kindergarten or first grade, then the child is missing on this outcome.

MATERNAL WELL-BEING

Maternal Coping Strategies

Mastery measures the extent to which people think life chances are under their control. This outcome is constructed in a similar way for the COVID-19 survey and kindergarten follow-up using the seven-item Pearlin Mastery Scale,¹¹ which was administered as part of the surveys. Items ask about whether the mother feels that she has control over her life, whether she has the ability to resolve her issues, and in general, feels she has agency over her life. Response options range from 1, indicating the mother strongly agrees with the statement, to 4, indicating the mother strongly disagrees with the statement. Mastery is equal to the sum of the seven items. At the COVID-19 time point, if one item is missing, mastery is equal to the mean of the present items, multiplied by seven. If more than one item is missing, the mother is missing on this outcome. At kindergarten, these items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point. Scores range from 7 to 28, with higher scores indicating higher levels of mastery.

Perceived social support measures how often various types of social support are available if needed. This outcome is based on five items that ask the degree to which the mother feels like she has social support.¹² These types of support include tangible support ("someone to help you with daily chores if you were sick"), emotional support ("someone to confide in or talk to about your problems"), and informational support ("someone to turn to for suggestions about how to deal with a personal problem"). Response options range from 1, indicating the mother never agrees with the statement, to 5, indicating the mother agrees with the statement all of the time. Social support is equal to the sum of the five items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was

11. Pearlin and Schooler (1978).

12. McCarrier et al. (2011).

implemented. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome. Scores range from 5 to 25 with higher scores indicating higher levels of social support.

Resource mobilization assesses whether mothers can find resources and feel empowered to do so. This outcome is constructed in a similar way for the COVID-19 survey and kindergarten follow-up using four items from the mobilizing resources subscale of the Healthy Families Parenting Inventory, which was developed specifically for home visiting programs.¹³ The items were distributed as part of the surveys. Items ask whether the mother feels she has access to resources for herself or her family. Response options range from 1, indicating the mother rarely or never agrees with the statement, to 5, indicating the mother always or most of the time agrees with the statement. Mobilizing resources is equal to the sum of the four items. At the COVID-19 time point, if one item is missing, mobilizing resources is equal to the mean of the present items, multiplied by four. If more than one item is missing, then the mother is missing on this outcome. At kindergarten, these items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point. Scores range from 4 to 20 with higher scores indicating higher levels of resource mobilization.

Parenting Distress

Parenting distress assesses the overall level of parenting stress experienced by the mother. This outcome is measured using five items from an adapted version of the Parenting Stress Index—Short Form,¹⁴ which was administered as part of the caregiver survey. Items ask whether the mother feels overly burdened by the responsibilities of parenting and whether she feels overly limited in exploring her own relationships or hobbies. Response options range from 1, indicating the mother strongly disagrees with the statement, to 5, indicating the mother strongly agrees with the statement. Parental distress is equal to the sum of the five items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome. Scores range from 5 to 25 with higher scores indicating higher levels of parental distress.

Maternal Depressive Symptoms

Exhibits depressive symptoms indicates whether the mother was experiencing depressive symptoms at the time of the survey. This outcome is constructed the same way for the

13. LeCroy and Milligan Associates, Inc. (2004). Modified, with permission from developer on 10/31/2018.

14. Whiteside-Mansell et al. (2007).

COVID-19 survey and kindergarten follow-up, using the standard 10-item version of the Center for the Epidemiologic Studies—Depression (CES-D) Scale,¹⁵ which was administered as part of the surveys. Items ask about whether the mother feels depressed, has difficulty sleeping, or has difficulty navigating life. Response options range from 0 (meaning that the mother felt this way less than 1 day in the past week) to 3 (meaning that the mother felt this way five to seven days in the past week). The outcome is first calculated by taking the sum of the items present if no items are missing to get a depressive symptoms raw score. If one or two items are missing, the mean of the items present is multiplied by 10 to get a depressive symptoms raw score. If the raw score is greater than or equal to 8, then the mother is considered to have exhibited depressive symptoms in the week before the survey. If the score is less than 8, then she is not considered to have exhibited depressive symptoms in the week before the survey. If the mother did not respond to three or more items, then she is missing on this outcome. If someone other than the child’s biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Maternal Substance Use

Used illicit drugs indicates whether the mother used nonprescription substances in the past three months. This outcome is measured using seven survey items about drug use that were adapted from the Pregnancy Risk Assessment Monitoring System (PRAMS),¹⁶ administered as part of the caregiver survey. Mothers were asked about their use of prescription painkillers, cocaine, marijuana, and tranquilizers. If the mother indicates that she used any of the drugs listed, then she is considered to have used illicit drugs in the past three months. If the mother did not respond to at least one item and responded to the remaining items indicating that she did not use the specified substance, then she is missing on this outcome. If someone other than the child’s biological mother responded to the survey, the mother is missing on this outcome.

Excessive drinking indicates whether the mother engaged in heavy drinking or binge drinking in the past three months. There were two separate sets of items administered to participants depending on their cohort.

For Cohort 1, four items were sourced from the Cut down, Annoyed, Guilty, and Eye-opener (CAGE)¹⁷ questionnaire that asked about the mother’s feelings and attitudes toward her drinking behaviors, such as whether she ever felt she should cut down on her drinking. Mothers responded to each item with either “Yes” (values of 1) or “No” (values of 0). The CAGE raw score is first calculated by taking the average of the items present and multiplying the average by 4 (the total number of expected items). If the CAGE raw score was equal to two or more, then she is considered to have engaged in excessive drinking. If the CAGE

15. Radloff (1977).

16. Pregnancy Risk Assessment Monitoring System (PRAMS) (2024).

17. Ewing (1984).

raw score was equal to less than two, then she is not considered to have engaged in excessive drinking. If the mother responded to less than 3 of the items, she is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

Due to a lack of variability in this outcome for Cohort 1, this outcome was measured for Cohorts 2 through 4 using two survey items about alcohol use that were adapted from the Pregnancy Risk Assessment Monitoring System (PRAMS).¹⁸ These items ask about the number of drinks she has in an average week and the number of times in a week she has four or more drinks in one sitting. If the mother indicates that she drank eight or more drinks in an average week or four or more drinks in one sitting at least once, then she is considered to have engaged in excessive drinking in the past three months. If the mother indicated that she drank fewer than eight drinks in an average week and fewer than four drinks in one sitting at least once, then she is not considered to have engaged in excessive drinking in the past three months. If the mother did not respond to one item and did not indicate on the present item that she engages in excessive drinking or if the mother did not respond to either item, the mother is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

FAMILY CONFLICT AND VIOLENCE

Family Conflict

Family conflict assesses the amount of openly expressed anger or lack of cohesion among family members. This scale consists of five items sourced from the family conflict subscale of the Family Environment Scale,¹⁹ which was administered as part of the caregiver survey. Items ask about whether the family fights frequently, whether members of the family exhibit anger control issues, and whether the family is physically or emotionally abusive to each other. Response options range from 1, indicating the mother strongly agrees with the statement, to 4, indicating the mother strongly disagrees with the statement. Family conflict is equal to the average of the five items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the biological mother responded to the survey or if the mother reported the child was not in kindergarten or first grade, the family is missing on this outcome. Scores range from 1 to 4 with higher scores indicating higher levels of family conflict.

18. Pregnancy Risk Assessment Monitoring System (PRAMS) (2024).

19. Moos and Moos (2009). Subset of items from the FES and modified by the survey administrator.

Intimate Partner Violence

Maternal experience with physical violence indicates whether the mother experienced physical violence in her current relationship. This outcome is measured using four items from the physical assault subscale of the Revised Conflict Tactics Scale (CTS2)²⁰ administered as part of the caregiver survey. Items ask about the number of times the mother's partner has physically abused the mother by throwing objects, hitting or grabbing the mother, or using weapons against the mother. If the mother indicated that she experienced physical violence in her current relationship at least once, then she is considered to have experience with physical violence. If the mother indicated she never experienced physical violence or if the mother reported she was not in a relationship, then she is not considered to have experience with physical violence. If the mother was in a relationship and one or more of the CTS2 items were missing and the mother indicated she never experienced any of the other actions, or if there is no answer recorded for whether the mother was in a relationship, then she is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

Maternal perpetration of physical violence indicates whether the mother perpetrated physical violence in her current relationship. This outcome is measured using items from the physical assault subscale of the Revised Conflict Tactics Scale (CTS2),²¹ administered as part of the caregiver survey. Items ask about the number of times the mother has thrown objects at her partner, hit or grabbed her partner, or used weapons against her partner. If the mother indicated she perpetrated an act at least once, then she is considered to have perpetrated physical violence. If the mother indicated she never perpetrated an act or if the mother was not in a relationship at the time of the survey, then she is not considered to have perpetrated physical violence. If the mother was in a relationship and one or more of the CTS2 items were missing and the mother indicated she never did any of the other actions, or if there is no answer recorded for whether the mother was in a relationship, then she is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

Maternal experience with battering assesses whether the mother experienced battering. This outcome is measured using six items from the Women's Experience with Battering scale, which were chosen in consultation with scale developer Paige Smith as a short form of the scale.²² These items were administered as part of the caregiver survey. Items ask about the mother's experience of feeling unsafe around her partner, feeling afraid of her partner's actions and reactions, and feeling controlled by her partner. Response options range from 1, indicating that the mother strongly disagrees with the statement, to 6, indicating that she strongly agrees with the statement. The experience with battering raw score is

20. For the CTS2, see Straus, Hamby, and Warren (2003).

21. For the CTS2, see Straus, Hamby, and Warren (2003).

22. For more information on the Women's Experience with Battering scale, see Smith, Earp, and DeVellis (1995).

first calculated, and the outcome measure reflects whether those scores fall above or below a threshold set in accordance with the developer's scoring instructions. If the mother said that she was currently in a relationship and she answered all six of the scale items, then the experience with battering raw score is equal to the sum of the responses. If the mother said that she was currently in a relationship and answered five of the scale items, then the experience with battering raw score is equal to the mean of the responses, multiplied by 6. If the experience with battering raw score is greater than or equal to 12, then the mother is considered to have experience with battering. If the experience with battering raw score is less than 12 or if the mother said that she was not in a relationship, then the mother is not considered to have experience with battering. If the mother did not say whether she was in a relationship, or if answers to two or more of the scale items are missing, then she is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

FAMILY ECONOMIC CIRCUMSTANCES

Education, Employment, and Income

Increase in education level since study entry assesses whether the mother meaningfully increased (see definition below) her education level since the time she entered the study. This outcome uses two items from the caregiver survey and one item from the baseline survey. The baseline survey item asks about the mother's highest level of education at the time of study entry. The caregiver survey items ask about the mother's highest level of education and whether she has a high school diploma or a high school equivalent. A meaningful increase is defined as:

- The mother indicated on the baseline survey that her highest level of education was no formal education or grade school between grades 1 through 12 with no high school diploma and indicated on the caregiver survey that her highest level of education is grade 12 with a high school diploma or high school equivalent, some college or a college degree, or a trade or technical school certificate.
- The mother indicated on the baseline survey that she has a high school diploma or equivalent or some college with no degree, and she indicated on the caregiver survey that she has a trade or technical school certificate or college degree.
- The mother indicated on the baseline survey that she has a trade or technical school certificate and indicated on the caregiver survey that she earned a college degree.
- The mother indicated on the baseline survey that she has a college degree and indicated on the caregiver survey that she earned a more advanced degree.

If the mother indicated that she does not have an education path that corresponds to one of the above statements, then she is not considered to have experienced an increase in education. If the mother did not respond to one of the items on either the baseline survey or caregiver survey, then she is missing on this outcome. If someone other than the child's biological mother responded to the caregiver survey, then the mother is missing on this outcome.

Receipt of high school diploma since study entry assesses whether mothers who did not have a high school diploma at study entry indicate on the caregiver survey that they have at least a high school diploma or high school equivalent. This outcome uses one item from the caregiver survey and one item from the baseline survey. The items ask about the mother's highest level of education at the time of the surveys. If the mother indicated she has less than a high school diploma or equivalent at baseline and indicated she has a high school diploma or equivalent or a higher level of education, then she is considered to have received a high school diploma since study entry. If the mother indicated she has less than a high school diploma or equivalent at baseline and indicated she has less than a high school diploma or equivalent at the time of the caregiver survey, then she is not considered to have received a high school diploma since study entry. If the mother did not respond to one of the two items or if the mother indicated she already had a high school diploma at baseline, then she is missing on this outcome. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

Quarters employed in the past year indicates the number of quarters the mother was employed in the year before direct data collection. This measure is based on quarterly wage records from the National Directory of New Hires.²³ Since individuals could be matched to the National Directory of New Hires only through their Social Security numbers (SSNs), the National Directory of New Hires sample does not include sample members who do not have a nine-digit SSN or who have a nonunique nine-digit SSN.

Average quarterly earnings in the past year indicates the average quarterly earnings in the year before direct data collection. This measure is based on quarterly wage records from the National Directory of New Hires. Since individuals could be matched to the National Directory of New Hires only through their Social Security numbers (SSNs), the National Directory of New Hires sample does not include sample members who do not have a 9-digit SSN or who have a nonunique 9-digit SSN.

Household income in the past year assesses total household income, including money from jobs and welfare. This measure uses items from the caregiver survey to calculate household income; survey respondents were asked to provide their exact income but could provide a range using a pre-specified list of responses if they were unsure about their exact income. If a range was provided, the midpoint of the range was used to estimate the mother's household income. These items were part of the planned missingness design. Missing

23. See U.S. Department of Health and Human Services, Administration for Children and Families, Office of Child Support Services (2023)

data for survey respondents were imputed using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the survey, then the mother is missing on this outcome.

Material Hardship

Food insecurity indicates whether the mother experienced food insecurity. This outcome is constructed in a similar way at the COVID-19 follow-up and kindergarten follow-up using the six-item short-form U.S. Household Food Security Survey Module,²⁴ administered as part of the surveys. Items ask, "Within the past 12 months, the food that we bought just didn't last and we didn't have money to get more," "In the past 12 months, did you or other adults in your household ever cut the size of your meals because there wasn't enough money for food?" and, "In the past 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?" Scoring for this outcome is based on affirmative responses to the six items. If the mother indicated she experienced two or more of the food insecurity items, then she is considered to have experienced food insecurity. If the mother indicated she experienced less than two of the food insecurity items, then she is not considered to have experienced food insecurity. At the COVID-19 time point, item severity was used to impute missing data. If the mother indicated she experienced a level of food insecurity on one of the more severe items and did not answer one of the less severe items, then she was considered to have experienced the less severe item of food insecurity as well. If the mother did not respond to one of the items and indicated she did not experience food insecurity on the present items, then she is missing on this outcome. At kindergarten, these items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Number of material hardships assesses the number of hardships that families may have faced because they lacked money (for example, not being able to pay the full utilities or rent/mortgage amount and forgoing medical care due to cost). This outcome is constructed in a similar way for the COVID-19 survey and kindergarten follow-up using five items from the Poverty Tracker Study, which was adapted from the Fragile Families and Child Wellbeing Study and the Survey of Income and Program Participation.²⁵ The five items were administered as part of the surveys. At the COVID-19 time point, the survey asks about hardships since the start of the pandemic. At kindergarten, the survey asks about hardships in the past year. The number of hardships is equal to the sum of the five items. At the COVID-19 time point, if one item is missing, the number of hardships is equal to the mean of the five items, multiplied by five. If more than one item is missing, the mother is missing on this outcome. At kindergarten, these items were part of the planned missingness design. Missing data

24. U.S. Department of Agriculture, Economic Research Service (2017).

25. See Robin Hood and Columbia Population Research Center (n.d.).

were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that timepoint.

Number of moves in the past year assesses housing mobility and indicates the number of times the mother has moved in the past year. This outcome is measured using one item from the caregiver survey that asks about the number of times the respondent has moved in the past 12 months. This item was part of the planned missingness design. Missing data were imputed for survey respondents using data collected at study entry and kindergarten. As a result, no missing rule was implemented. If someone other than the child's biological mother responded to the survey, the mother is missing on this outcome.

CHILD FUNCTIONING

Social Skills

Engagement refers to children's abilities to engage in social settings and make connections with peers. It is measured in the context of the home and school.

- **Engagement—home context** consists of seven items from the Social Skills Improvement System (SSIS),²⁶ which was administered as part of the caregiver survey. Items ask about the extent to which the child shows, initiates, or maintains interaction with the mother and communicates positive regard or affect to the mother. Response options range from 0 (meaning never) to 3 (meaning almost always). Engagement is equal to the sum of the seven items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at kindergarten. As a result, no missing rule was implemented. If the caregiver reported the child was not in kindergarten or first grade, the child is missing on this outcome. Scores range from 0 to 21 with a higher score indicating higher levels of engagement for the focal child.
- **Engagement—school context** consists of seven items from the Social Skills Improvement System (SSIS),²⁷ which was administered as part of the teacher survey. Items ask about the extent to which the child shows, initiates, or maintains interaction in a school context. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all seven items, then engagement is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the scale developers, if more than two

26. Gresham and Elliot (2008).

27. Gresham and Elliot (2008).

items are missing, then the child is missing on this outcome.²⁸ Scores range from 0 to 21 with a higher score indicating higher levels of engagement for the focal child.

Cooperation refers to children’s skills related to helping others, sharing materials, and complying with rules and directions. The subscale consists of six items from the Social Skills Improvement System (SSIS),²⁹ which was administered as part of the teacher survey. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all six items, then cooperation is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the scale developers, if more than two items are missing, the child is missing on this outcome.³⁰ Scores range from 0 to 18 with higher scores indicating higher levels of cooperation for the child.

Assertive social skills refer to a child’s interpersonal functioning and confidence in dealing with peers. The subscale consists of four items from the Teacher-Child Rating Scale (T-CRS 2.1),³¹ which was administered as part of the teacher survey. Items ask about the child’s ability to lead and participate in social interactions in a class and school setting. Response options range from 1 (meaning not at all) to 5 (meaning very well). If the teacher answered all four items, then assertive social skills is equal to the mean of the responses. Per instructions from the developers of the T-CRS, if one item is missing, the median of the three items present replaces the missing item. The median and the remaining three items are then averaged together. If more than one item is missing, the child is missing on this outcome.³² Scores range from 1 to 5 with higher scores indicating higher levels of assertive social skills for the child.

Behavior Problems

Externalizing behaviors include being verbally or physically aggressive, failing to control temper, and arguing. It is measured in the context of the home and school.

- **Externalizing behaviors—home context** consists of 12 items from the Social Skills Improvement System (SSIS),³³ which was administered as part of the caregiver survey. Items ask about whether the child exhibits hyperactivity, shows aggression toward others, or acts out. Response options range from 0 (meaning never) to 3 (meaning almost always). Externalizing behaviors is equal to the sum of the 12 items. These items were part of the planned missingness design. Missing data were imputed for survey respon-

28. Gresham and Elliot (2008).

29. Gresham and Elliot (2008).

30. Gresham and Elliot (2008).

31. Hightower and Perkins (2010).

32. Hightower and Perkins (2010).

33. Gresham and Elliot (2008).

dents using data collected at kindergarten. As a result, no missing rule was implemented. If the caregiver reported the child was not in kindergarten or first grade, the child is missing on this outcome. Scores range from 0 to 36 with a higher score indicating higher levels of externalizing behaviors for the child.

- **Externalizing behaviors—school context** consists of 12 items from the Social Skills Improvement System (SSIS),³⁴ which was administered as part of the teacher survey. Items ask about whether the child exhibits hyperactivity, shows aggression toward others, or acts out in a school context. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all 12 items, then externalizing is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the scale developers, if more than two items are missing, then the child is missing on this outcome.³⁵ Scores range from 0 to 36 with a higher score indicating higher levels of externalizing behaviors for the child.

Internalizing behaviors include seclusion, negative self-speak, symptoms of depression, and exhibiting poor self-esteem. It is measured in the context of the home and school.

- **Internalizing behaviors—home context** consists of seven items from the Social Skills Improvement System (SSIS),³⁶ which was administered as part of the caregiver survey. Items ask about whether the child feels embarrassment easily, shows signs of anxiety, and has issues with eating and sleeping. Response options range from 0 (meaning never) to 3 (meaning almost always). Internalizing behaviors is equal to the sum of the 10 items. These items were part of the planned missingness design. Missing data for survey respondents were imputed using data collected at kindergarten. As a result, no missing rule was implemented. If the caregiver reported the child was not in kindergarten or first grade, the child is missing on this outcome. Scores range from 0 to 30 with a higher score indicating higher levels of internalizing behaviors for the child.
- **Internalizing behaviors—school context** consists of seven items from the Social Skills Improvement System (SSIS),³⁷ which was administered as part of the teacher survey. Items ask about whether the child feels embarrassment easily and shows signs of anxiety or depression in a school context. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all seven items, then internalizing behaviors is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the

34. Gresham and Elliot (2008).

35. Gresham and Elliot (2008).

36. Gresham and Elliot (2008).

37. Gresham and Elliot (2008).

scale developers, if more than two items are missing, then the child is missing on this outcome.³⁸ Scores range from 0 to 21 with a higher score indicating higher levels of internalizing behaviors for the child.

Emotional and Behavior Self-Regulation

Emotional self-control refers to whether children control their emotions and respond appropriately in conflict and non-conflict situations.

- **Emotional self-control—home context** consists of seven items from the Social Skills Improvement System (SSIS),³⁹ which was administered as part of the caregiver survey. Items ask about whether the child can stay calm in stressful situations and handle difficult peers. Response options range from 0 (meaning never) to 3 (meaning almost always). Emotional self-control is equal to the sum of the seven items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at kindergarten. As a result, no missing rule was implemented. If the caregiver reported the child was not in kindergarten or first grade, the child is missing on this outcome. Scores range from 0 to 21 with higher scores indicating higher levels of emotional self-control for the child.
- **Emotional self-control—school context** consists of seven items from the Social Skills Improvement System (SSIS),⁴⁰ which was administered as part of the teacher survey. Items ask about whether the child stays calm in difficult situations, uses words appropriately, and is able to resolve disputes with peers/teachers. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all seven items, then emotional self-control is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the scale developers, if more than two items are missing, then the child is missing on this outcome.⁴¹ Scores range from 0 to 21 with higher scores indicating higher levels of emotional self-control for the child.

Hyperactivity/inattention refers to behavior characterized by moving about excessively, having impulsive reactions, and demonstrating lack of concentration.

- **Hyperactivity/inattention—home context** consists of seven items from the Social Skills Improvement System (SSIS),⁴² which was administered as part of the caregiver survey. Items ask about whether the child acts impulsively and exhibits emotional control

38. Gresham and Elliot (2008).

39. Gresham and Elliot (2008).

40. Gresham and Elliot (2008).

41. Gresham and Elliot (2008).

42. Gresham and Elliot (2008).

issues. Response options range from 0 (meaning never) to 3 (meaning almost always). Hyperactivity/inattention is equal to the sum of the seven items. These items were part of the planned missingness design. Missing data were imputed for survey respondents using data collected at kindergarten. As a result, no missing rule was implemented. If the caregiver reported the child was not in kindergarten or first grade, the child is missing on this outcome. Scores range from 0 to 21 with higher scores indicating higher levels of hyperactivity/inattention for the child.

- **Hyperactivity/inattention—school context** consists of seven items from the Social Skills Improvement System (SSIS),⁴³ which was administered as part of the teacher survey. Items ask about whether the child acts impulsively and exhibits emotional control issues in a school context. Response options range from 0 (meaning never) to 3 (meaning almost always). If the teacher answered all seven items, then hyperactivity/inattention is equal to the sum of the items. As determined by the developers of the SSIS scale, if one or two items are missing, an adjustment factor replaces the missing item or items. The adjustment factor(s) and the remaining items are summed together. Per the scale developers, if more than two items are missing, then the child is missing on this outcome.⁴⁴ Scores range from 0 to 21 with higher scores indicating higher levels of hyperactivity/inattention for the child.

Attention/impulse control refers to whether the child displayed emotion regulation, attention, and impulse control. The subscale consists of 18 items from the Preschool Self-Regulation Assessment Assessor Report (PSRA-AR),⁴⁵ which was completed by trained assessors and based on their observations of children’s self-regulation during direct assessments. Factor analysis was used to identify a two-factor solution to determine which of the 28 items from the full PSRA-AR mapped onto this outcome as was done in the Chicago School Readiness Project and The Expanding Children’s Early Learning Network.⁴⁶ Items ask about whether the child is easily distracted or resistant to instruction. Response options range from 0 (indicating more impulsive actions) to 3 (indicating less impulsive actions). Attention/impulse control is equal to the mean of the 18 items. This measure had no item missingness. Scores range from 0 to 3 with higher scores indicating higher levels of attention and impulse control.

Task orientation refers to a child’s ability to focus on school-related tasks. The subscale consists of four items from the Teacher-Child Rating Scale (T-CRS 2.1),⁴⁷ which was administered as part of the teacher survey. Items ask about whether the child works independently and completes tasks in a school context. Response options range from 1 (meaning not at all) to 5 (meaning very well). If the teacher answered all four items, then task orientation is equal to the mean of the responses. Per instructions from the developers of the T-CRS, if

43. Gresham and Elliot (2008).

44. Gresham and Elliot (2008).

45. Raver et al. (2011).

46. Moffett et al. (2024); Raver et al. (2011).

47. Hightower and Perkins (2010).

one item is missing, the median of the three items present replaces the missing item. The median and the remaining three items are then averaged together. Per the scale developers, if more than one item is missing, the child is missing on this outcome.⁴⁸ Scores range from 1 to 5 with higher scores indicating higher levels of task orientation for the child.

Frustration tolerance refers to a child's skills in tolerating and adapting to limits imposed by the school environment or by the child's own limitations. The subscale consists of four items from the Teacher-Child Rating Scale (T-CRS 2.1),⁴⁹ which was administered as part of the teacher survey. Items ask about whether the child is able to handle disappointment and limitation in a school context. Response options range from 1 (meaning not at all) to 5 (meaning very well). If the teacher answered all four items, then frustration tolerance is equal to the mean of the responses. Per instructions from the developers of the T-CRS, if one item is missing, the median of the three items present replaces the missing item. The median and the remaining three items are then averaged together. Per the scale developers, if more than one item is missing, the child is missing on this outcome.⁵⁰ Scores range from 1 to 5 with higher scores indicating higher levels of frustration tolerance for the child.

Behavior Toward Parent During Semi-Structured Task

Outcomes within this sub-area were assessed during the Three-Bag Task, a semi-structured play interaction administered as part of the direct assessments, which is described in detail above. If someone other than the child's biological mother participated in the interaction, the child is missing on these outcomes.

Child engagement of parent reflects the extent to which the child initiates or maintains interaction with the parent and communicates positive regard or positive affect to the parent during semi-structured play. The scale ranges from 1 (very low engagement) to 7 (very high engagement).

Child negativity toward parent captures the degree to which the child shows anger, hostility, or dislike toward the parent during semi-structured play. The scale ranges from 1 (very low negativity) to 7 (very high negativity).

Cognitive Skills

Inhibitory control—percent correct on valid trials refers to a child's ability to resist distractions and temptations and suppress impulsive behaviors or thoughts.⁵¹ In the Hearts and Flowers task, administered during the direct assessments with children, inhibitory control is measured by the child's performance on the incongruent trials. The incongruent trials require

48. Hightower and Perkins (2010).

49. Hightower and Perkins (2010).

50. Hightower and Perkins (2010).

51. Obradović, Portilla, and Boyce (2012).

the child to resist selecting the response on the same side as was done on the congruent trials, and instead select the response on the opposite side within the time allotted. The task consisted of 13 main test trials. Trials were considered not valid if the response time was greater than 2.5 seconds or less than 0.2 seconds (the latter is referred to as an anticipatory response) or if the child failed to provide a response before the screen moved on to the next trial. Accuracy is calculated as the percentage of valid trials that were performed correctly and ranges from 0 to 1. Children are missing on this outcome if there were persistent technical issues when administering the task, the field assessor indicated the child was not able to complete the task, more than 40 percent of incongruent trials were not valid, their overall accuracy across the congruent, incongruent, and mixed trials was less than 50 percent, or accuracy within the incongruent block is 0 percent.

Cognitive flexibility—percent correct on valid trials refers to a child’s ability to shift attention or responses between competing mental states or rules.⁵² In the Hearts and Flowers task, administered during the direct assessments with children, cognitive flexibility is measured by the child’s performance on the mixed trials, which switch back and forth between congruent and incongruent trials in an unpredictable pattern. Thus, children need to respond based on the rule designated for each type of trial. The task consisted of 33 main test trials. Trials were considered not valid if the response time was greater than 2.5 seconds or less than 0.2 seconds (known as an anticipatory response) or if the child failed to provide a response before the screen moved on to the next trial. Accuracy is calculated as the percentage of valid trials that were performed correctly and ranges from 0 to 1. Children are missing on this outcome if there were persistent technical issues when administering the task, the field assessor indicated the child was not able to complete the task, more than 40 percent of mixed trials were not valid, their overall accuracy across the congruent, incongruent, and mixed trials was less than 50 percent, or accuracy within the incongruent block is 0 percent and accuracy within the mixed block is less than 50 percent.

Short-term memory refers to the capacity to store a small amount of information in the mind and keep it readily available for a short period of time.⁵³ Short-term memory was assessed using the Forward Digit Span task from the Wechsler Intelligence Scale for Children—4th edition (WISC-IV),⁵⁴ which was administered as part of the direct assessments with children. The task consisted of two practice items and 10 test trials and asked children to repeat a sequence of numbers of increasing length. Test trials started at two numbers and increased to six numbers. The score indicates the length of the longest sequence the child repeated and ranges from 1 to 6. If the child got at least one practice item correct but did not get any of the test trials correct, the child has a score of 1. Children are missing on this outcome if there were persistent technical issues when administering the task, if they are missing all test trials, or if they did not respond correctly to at least one practice or test trial.⁵⁵

52. Obradović, Portilla, and Boyce (2012).

53. Healy (2001).

54. Flanagan and Kaufman (2009).

55. Flanagan and Kaufman (2009).

Language Development

Vocabulary knowledge was measured via direct assessment using the Picture Vocabulary test from the Woodcock-Johnson IV Tests of Oral Language.⁵⁶ This test assesses oral language development by having the children point to a few pictures of objects on an easel panel that the assessor names and then, for other questions, identify the objects to which the assessor is pointing. The Spanish version of the test found in the same battery assesses this outcome for children whose dominant language is Spanish. A transformation of the raw score known as the w-score was calculated using the child's grade at the time of assessment and normative scoring software from the developers of the test. The w-score allows users to pool scores from the English and Spanish versions of the test. The w-score within the sample ranges from 360 to 505 with higher values indicating greater vocabulary knowledge.

Mathematics Development

Early numeracy and math skills was measured via direct assessment using the Applied Problems test from the Woodcock-Johnson III: Tests of Achievement.⁵⁷ This test measures children's ability to solve oral math problems (for example, the child may be asked to count the number of animals in a picture). A Spanish version of the test is also available from the Bateria III Woodcock-Muñoz to assess this outcome for children whose dominant language is Spanish.⁵⁸ A transformation of the raw score known as the w-score was calculated using the child's grade at the time of assessment and normative scoring software from the developers of the test. The w-score allows users to pool scores from the English and Spanish versions of the test. The w-score within the sample ranges from 301 to 498 with higher values indicating greater numeracy and math skills.

OTHER OUTCOMES

The outcomes in this section do not contribute to the pre-specified topical research questions.

Quality of Play During Semi-Structured Task

Quality of play was assessed during the Three-Bag Task, a semi-structured play interaction administered as part of the direct assessments, which is described in detail above. This outcome assesses the child's sustained involvement with the toys and the quality of the child's play during semi-structured play. Children engaging in high-quality play are consistently involved in their play, appear motivated throughout the task, clearly exert effort, make

56. Schrank, Mather, and McGrew (2014).

57. Woodcock, McGrew, Mather (2001).

58. Woodcock, Muñoz-Sandoval, McGrew, and Mather (2007). The Woodcock-Johnson IV Applied Problems subtest was not considered for this follow-up because the Spanish version was not yet available when the study was designed.

attempts at new forms of play, and play with confidence. The scale ranges from 1 (very low quality of play) to 7 (very high quality of play). If someone other than the child's biological mother participated in the interaction, the child is missing on this outcome.

Public Assistance Receipt

Supplemental Nutrition Assistance Program (SNAP) indicates whether the mother reported that she had received benefits from SNAP. This outcome is constructed the same way for the COVID-19 survey and kindergarten follow-up and is based on one item from each of the surveys. At the COVID-19 time point, the survey asks about SNAP receipt in the past two months. At kindergarten, the survey asks about SNAP receipt in the past month. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Women, Infants, and Children (WIC) indicates whether the mother reported that she had received benefits from the Special Supplemental Nutrition Program for Women, Infants, and Children. The outcome is constructed the same way for the COVID-19 survey and kindergarten follow-up and is based on one item from each of the surveys. At the COVID-19 time point, the survey asks about WIC receipt in the past two months. At kindergarten, the survey asks about WIC receipt in the past month. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Temporary Assistance for Needy Families (TANF) indicates whether the mother reported that she had received benefits from TANF. The outcome is constructed the same way for the COVID-19 survey and kindergarten follow-up and is based on one item from each of the surveys. At the COVID-19 time point, the survey asks about TANF receipt in the past two months. At kindergarten, the survey asks about TANF receipt in the past month. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Disability insurance indicates whether the mother reported on the caregiver survey that she had received benefits in the past month from Supplemental Security Income or Social Security Disability Insurance. The outcome is constructed the same way for the COVID-19 survey and kindergarten follow-up and is based on one item from each of the surveys. At the COVID-19 time point, the survey asks about disability insurance receipt in the past two months. At kindergarten, the survey asks about disability insurance receipt in the past month. If someone other than the child's biological mother responded to the COVID-19 survey or caregiver survey, the mother is missing on the outcome that corresponds to that time point.

Medicaid receipt is based on whether Medicaid enrollment records indicate that the mother received benefits in the past month from Medicaid. The data are sourced from the Research Data Assistance Center on behalf of the Centers for Medicare and Medicaid Services. If the mother was enrolled in Medicaid the December of the year of data collection, then the mother was considered enrolled in Medicaid. If the mother was not enrolled in Medicaid, the

mother was not considered to be enrolled in Medicaid. If the mother did not match to the Medicaid data due to a lack of identifiers, then the mother is missing on this outcome. Due to lags in data availability, mothers in Cohort 4 are missing on this outcome.

COVID Web Survey

Working for pay indicates whether the mother reported on the COVID-19 survey that she was working for pay at the time the survey was administered. The outcome is based on one item from the survey that asks if the mother was working for pay. If someone other than the child's biological mother completed the survey, then the mother is missing on this outcome.

SUBGROUP CHARACTERISTICS

Mother's level of psychological resources indicates whether the mother had a lower level or higher level of psychological resources at study entry. This maternal characteristic is based on a composite of (1) mental health, (2) mastery, and (3) verbal abstract reasoning. These three measures are based on scales administered on the baseline survey and are created as follows:

- *Mental health* is a composite of depressive symptoms and anxiety.
 - Depressive symptoms is constructed using the standard 10-item version of the Center for the Epidemiologic Studies—Depression (CES-D) Scale,⁵⁹ which was administered as part of the baseline survey. Response options range from 0 (meaning that the mother felt this way less than 1 day in the past week) to 3 (meaning that the mother felt this way five to seven days in the past week). The depressive symptoms score is calculated by taking the sum of the items present if no items are missing. If one or two items are missing, the depressive symptoms score is calculated by taking the mean of the items present multiplied by 10. If the mother did not respond to three or more items, then she is missing on this measure.
 - Anxiety is constructed using the Generalized Anxiety Disorder 7-item scale (GAD-7),⁶⁰ which was administered as part of the baseline survey. The anxiety symptoms score is calculated by taking the sum of the items present if no items are missing. If the mother answered six items, then the measure is equal to the mean of the responses present, multiplied by seven. If the mother answered fewer than six items, the mother is missing on this measure.

To create the mental health composite, the depressive symptoms score and anxiety score are each standardized so they have a mean of 100 and a standard deviation of 10. These

59. Radloff (1977).

60. Spitzer, Kroenke, Williams, and Löwe (2006).

standardized measures of depression and anxiety are then summed together. Before creating the composite of mother's level of psychological resources, values are reverse coded such that higher values indicate lower levels on the mental health composite.

- *Mastery* measures the extent to which a person thinks life chances are under his or her control. Mastery is measured using the seven-item Pearlin Mastery Scale⁶¹ which was administered as part of the baseline survey. Items ask whether the mother feels that she has control over her life, whether she has the ability to resolve her issues, and in general, feels she has agency over her life. Response options range from 1, indicating the mother strongly agrees with the statement, to 4, indicating the mother strongly disagrees with the statement. Mastery is equal to the sum of the seven items. If one item is missing, mastery is equal to the mean of the present items, multiplied by seven. If more than one item is missing, the mother is missing on this measure. Scores range from 7 to 28, with higher scores indicating higher levels of mastery.
- *Verbal abstract reasoning* is measured using the Similarities Subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III)⁶² and the Spanish equivalent Escala de Inteligencia de Wechsler para Adultos-Tercera Edición (EIWA-III)⁶³ administered as part of the baseline survey. Scores are created per the developer's instructions and then standardized according to the language in which the survey was administered and the age of the respondent. Higher scores indicate higher levels of verbal abstract reasoning.

To create the composite of the mother's level of psychological resources, the scores for mental health, mastery, and verbal abstract reasoning are summed together and standardized. Mothers with a score of greater than 100 are considered to have higher psychological resources. Those with a score of 100 or less are considered to have lower psychological resources.

Mother's level of emotional functioning indicates whether the mother was at risk due to her attachment style and depressive symptoms at study entry. This maternal characteristic is a composite of depressive symptoms, avoidant attachment style, and anxious attachment style.

- *Depressive symptoms* indicates whether the mother was experiencing depressive symptoms at the time of the survey. Depressive symptoms is constructed using the standard 10-item version of the Center for the Epidemiologic Studies—Depression (CES-D) Scale,⁶⁴ which was administered as part of the baseline survey. Items ask about whether the mother feels depressed, has difficulty sleeping, or has difficulty navigating life. Response options range from 0 (meaning that the mother felt this way less than 1 day in the past

61. Pearlin and Schooler (1978).

62. Wechsler (1997).

63. Wechsler (2008).

64. Radloff (1977).

week) to 3 (meaning that the mother felt this way five to seven days in the past week). Depressive symptoms is first calculated by taking the sum of the items present, if no items are missing to get a depressive symptoms raw score. If one or two items are missing, the mean of the items present is multiplied by 10 to get a depressive symptoms raw score. If the raw score is greater than or equal to 8, then the mother is considered to have exhibited depressive symptoms in the week before the survey. If the score is less than 8, then she is not considered to have exhibited depressive symptoms in the week before the survey. If the mother did not respond to three or more items, then she is missing on this outcome.

- *Avoidant attachment style* is based on the Attachment Style Questionnaire administered on the baseline survey. The avoidant attachment style scale score is calculated by taking the sum of the items. If the score is greater than 56, the mother is considered to have an avoidant attachment style. If the score is 56 or lower, the mother is not considered to have an avoidant attachment style. If four or more items are missing, then the mother is missing on this measure.
- *Anxious attachment style* is based on the Attachment Style Questionnaire administered on the baseline survey. The anxious attachment style scale score is calculated by taking the sum of the items. If the score is greater than 45.5, the mother is considered to have an anxious attachment style. If the score is 45.5 or lower, the mother is not considered to have an anxious attachment style. If four or more items are missing, then the mother is missing on this measure.

Mothers who are not above the cutoff on any of the measures are no risk, mothers who are above the cutoff on one measure are lower risk, and mothers who are above the cutoff on two or three measures are higher risk. If the mother is missing any of the above measures, then she is missing on this maternal characteristic.

Presence of intimate partner violence between mother and partner indicates whether such violence occurred over the year prior to study entry (either experienced or perpetrated by the mother with her current spouse or partner). If the mother reported that any of the items in the Revised Conflict Tactics Scale (CTS2)⁶⁵ occurred at least once, then there is intimate partner violence in the relationship. If the mother reported that none of the items ever occurred, then there is not intimate partner violence in the relationship. If the mother did not respond to one of the items and indicates on the present items that the intimate partner violence never occurred, then she is missing on this maternal characteristic. This maternal characteristic is missing if the mother was not in a relationship at the time of study entry.

Mother's number of adverse childhood experiences (ACEs) indicates whether the mother identifies as having no ACEs, one or two ACEs, or three or more ACEs. This maternal characteristic is based on the 8-item Child Trends ACE Module, administered as part of the

65. Straus, Hamby, and Warren (2003).

kindergarten caregiver survey.⁶⁶ Items ask about the mother's living conditions before age 18. For seven of the eight items, mothers are asked to respond with "Yes" or "No," indicating whether they experienced the ACE or not. For one item, mothers are asked how often their family found it hard to cover the costs of food and housing. If the mother indicated that her family experienced this somewhat often or often, then she is considered to have experienced this ACE. The eight ACE items were then summed, and respondents were placed into the appropriate category. The measure is missing if any item was missing or if the respondent was not the biological mother.

Mother's number of demographic risk factors indicates the mother's risk level at study entry. This maternal characteristic is an index based on four risk factors:

- The mother is a young mother (between the ages of 15 and 20 years old), measured using the mother's age at study entry.
- The biological father of the focal child does not live in the home, measured using the household roster from the baseline survey.
- The mother or a household member received public assistance from WIC, disability insurance, SNAP, or TANF in the prior month or the mother was enrolled in Medicaid at study intake based on Medicaid records, baseline survey items that ask about Medicaid coverage, and baseline survey items asking about benefit receipt. The mother is considered to be receiving public assistance if the Medicaid data indicate she was enrolled at baseline, or she reported on the baseline survey that she had Medicaid coverage currently, or that she or someone else in the household had received WIC, disability insurance, SNAP, or TANF in the prior month.
- The mother has low educational attainment for her age based on baseline survey items about education and training and the mother's age at study entry. If the mother is 18 years old or younger, she is considered to be at risk if she has not completed a high school diploma or a trade, vocational, or certificate credential and is not currently enrolled in education or training. If the mother is 19 years old or older, then she is considered to be at risk if she does not have a high school diploma or a trade, vocational, or certificate credential. Mothers who reported GED as their highest level of education are not considered to have their high school diploma.

If the mother has fewer than three risk factors, then she is considered to exhibit low risk. If the mother has three or four risk factors, then she is considered to exhibit a moderate to high level of risk. This maternal characteristic is defined differently from the maternal characteristic used in prior MIHOPE reports. Given lower response rates at the kindergarten follow-up, mothers exhibiting a moderate level of risk and mothers exhibiting a high level of risk were combined into one group.

66. Sacks, Murphey, and Moore (2014).

Parity is a maternal characteristic that indicates whether the mother was a first-time mother at study entry. It is based on the household roster from the baseline survey and vital records data. Respondents were considered *not* to be first-time mothers if the mother indicated the focal child's sibling or stepsibling on the household roster or if birth certificate data indicated the mother had any previous live births, either living or deceased. If the mother did not match to vital records, then she is considered a first-time mother if she does not report any siblings of the focal child on the household roster section of the survey.

Child's gestational age at enrollment indicates whether the mother was: (1) 28 weeks pregnant or less, (2) more than 28 weeks pregnant, or (3) the baby was already born when she entered the study. It is based primarily on obstetric estimate of gestational age at birth and the child's date of birth from birth certificate data. If birth certificate data were not available, the mother's due date as reported on the baseline survey was used instead.

Mother's race and ethnicity indicates whether the mother identifies as non-Hispanic White, non-Hispanic Black, or Hispanic. This maternal characteristic is based on responses to two family baseline survey questions: "Are you of Hispanic, Latino, or Spanish origin?" and "What is your race? You may name more than one if you'd like." If the mother indicated she was of Hispanic, Latino, or Spanish origin or indicated whether she was Hispanic when asked her race, then she is considered to be Hispanic. If the mother indicated she was not of Hispanic, Latino, or Spanish origin, and only identified as white when asked her race, then she is considered to be non-Hispanic White. If the mother indicated she was not of Hispanic, Latino, or Spanish origin, and only identified as Black when asked her race, then she is considered to be non-Hispanic Black.

If the mother indicated she did not identify as Hispanic, Latino, or Spanish origin and identified as more than one race, then she is missing on this measure. In prior MIHOPE reports, women were considered to be Multiracial/Another race. Given lower response rates at the kindergarten follow-up, this group of women was too small to include in the subgroup analyses. If the mother was missing either item, then she is missing on this measure.

APPENDIX

B

Response Bias Analyses

Most of the estimated effects included in this report are calculated for families who responded to the caregiver survey, families with whom direct assessments were conducted by trained interviewers, and families whose children’s teachers responded to the teacher survey. This appendix chapter assesses the potential bias in the study findings resulting from families who are missing one or more of these data collection elements at kindergarten. The appendix addresses two questions:

- **Are there systematic differences in baseline characteristics between program and control group families in the respondent sample?** To answer this question, the team compared the baseline characteristics of program group families who completed follow-up data collection with the characteristics of control group families who completed follow-up data collection.
- **Are there systematic differences in baseline characteristics between families who completed the kindergarten data collection and those who did not?** To answer this question, the team compared the baseline characteristics of families who completed follow-up data collection (respondents) with those of families who did not (nonrespondents).

BASELINE CHARACTERISTICS OF THOSE WHO COMPLETED FOLLOW-UP DATA COLLECTION

Appendix Table B.1 compares selected baseline characteristics between the program and control group among families who completed any part of the caregiver survey. Appendix Table B.2 presents the same comparison between program and control group families who completed any part of the direct assessments. Appendix Table B.3 shows the same comparison between program and control group families who had a teacher respond to any part of the teacher survey. The tables include p-values to assess whether differences between the two groups for individual characteristics were statistically significant.

Follow-up data collection might produce biased estimates of effects if program group respondents differed systematically from control group respondents when they entered the study. Although each table shows some statistically significant differences between the research groups, some differences are expected by chance because of the number of characteristics shown. To confirm that there was no systematic difference between the two groups, a logistic regression was run using baseline variables to predict research group status among respondents. A joint test indicated that the baseline characteristics are not collectively related to whether the family was in the program or control group (the p-value is 0.999 for the caregiver survey, 0.993 for the direct assessments, and 0.106 for the teacher survey). In other words, the number of statistically significant differences between the groups is no more than would be expected by chance, suggesting that differences between the groups are unlikely to be a source of bias.

Appendix Table B.1. Comparison of Selected Baseline Characteristics Between Program and Control Groups Among Caregiver Survey Respondents

Characteristic	Program Group	Control Group	Difference	P-Value
Maternal and household characteristics				
Average age (years)	23.86	24.18	-0.32	0.182
Pregnant (%)	64.11	61.63	2.48	0.204
Relationship status (%)				0.192
Married to the focal child's biological father	21.43	21.59	-0.16	
Living with a partner or spouse	23.38	25.27	-1.90	
In a relationship but not living together	30.46	26.61	3.85	
Single	24.73	26.53	-1.80	
Race and ethnicity (%)				0.124
Mexican origin	25.23	26.04	-0.81	
Other Hispanic	13.20	12.82	0.38	
Non-Hispanic White	24.07	25.71	-1.65	
Non-Hispanic Black	30.79	26.78	4.01	
Other or multiracial	6.72	8.65	-1.93	
Average number of siblings of the focal child in the home	0.67	0.70	-0.03	0.465
Ability to speak English self-rated as "not very well" or "not at all" (%)	10.73	10.78	-0.05	0.970
Moved more than once during the past year (%)	17.71	18.82	-1.12	0.477
Economic circumstances (%)				
Food insecurity ^a	53.89	55.94	-2.05	0.311
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	60.17	58.33	1.84	0.358
Women, Infants, and Children Program	77.85	76.82	1.03	0.545
Temporary Assistance for Needy Families	18.57	19.65	-1.08	0.502
Disability insurance	16.39	17.77	-1.38	0.368
Maternal highest level of education				0.793
Less than a high school diploma or equivalent	40.03	41.31	-1.28	
High school diploma	33.03	31.97	1.06	
Some college or more	26.94	26.72	0.22	
Maternal employment during the past three years				0.943
Not employed	20.50	20.00	0.50	
Employed for 12 months or fewer	36.99	36.94	0.05	
Employed for more than 12 months	42.51	43.06	-0.55	
Currently taking or planning to take education or training classes	69.80	66.53	3.27	0.090
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	39.24	42.58	-3.34	0.095
Substance use before pregnancy (%)	29.72	30.47	-0.75	0.687
Average level of verbal abstract reasoning ^c	6.98	7.03	-0.05	0.627
Health status self-rated as "poor" or "fair" (%)	11.15	13.26	-2.12	0.111
Past behavioral health services (%)	18.70	21.60	-2.90	0.075

(continued)

Appendix Table B.1 (continued)

Characteristic	Program Group	Control Group	Difference	P-Value
Average level of mastery ^d	22.21	21.98	0.23	0.092
Smoked during the three months before pregnancy (%)	26.06	27.54	-1.48	0.411
Average body mass index	28.06	27.67	0.40	0.231
Intention to breastfeed (%)	87.18	82.60	4.58	0.014
Future childbearing intention (%)	13.06	12.35	0.72	0.610
Average perception of relationship quality with partner or spouse ^e	6.40	6.44	-0.04	0.466
Health insurance and access to care (%)				
Usual source of well-child care	93.33	91.08	2.25	0.206
Health insurance coverage for the mother	90.37	90.15	0.23	0.850
Crime and intimate partner violence (%)				
Arrested during the past year	5.81	4.99	0.83	0.368
Maternal experience with physical or sexual violence ^f	7.37	8.17	-0.80	0.464
Maternal perpetration of physical violence ^f	16.98	17.74	-0.76	0.622
Maternal experience with battering ^g	5.30	4.50	0.80	0.363
Past domestic violence services	7.31	8.20	-0.89	0.414
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.07	5.12	-0.06	0.701
Parental verbal skills	2.83	2.85	-0.03	0.186
Parental lack of hostility	4.67	4.57	0.10	0.274
Home interior	6.90	6.85	0.05	0.503
Low level of maternal empathy ⁱ (%)	20.20	21.76	-1.56	0.344
Child characteristics				
Average age (months)	1.45	1.44	0.01	0.945
Sex (%)				0.370
Female	51.12	49.30	1.82	
Male	48.88	50.70	-1.82	
Poor health at birth ⁱ (%)	26.45	22.46	3.99	0.166
Involvement with Child Protective Services before study entry (%)	5.44	2.15	3.29	0.015
Average level of emotionality ^k	2.21	2.32	-0.11	0.111
Sample size (total = 2,442)	1,212	1,230		

(continued)

Appendix Table B.1 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASIII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

Appendix Table B.2. Comparison of Selected Baseline Characteristics Between Program and Control Groups Among Direct Assessment Respondents

Characteristic	Program Group	Control Group	Difference	P-Value
Maternal and household characteristics				
Average age (years)	23.95	24.22	-0.27	0.270
Pregnant (%)	62.95	61.69	1.26	0.531
Relationship status (%)				0.325
Married to the focal child's biological father	21.46	21.68	-0.22	
Living with a partner or spouse	23.95	25.76	-1.81	
In a relationship but not living together	30.45	27.06	3.39	
Single	24.13	25.50	-1.37	
Race and ethnicity (%)				0.068
Mexican origin	26.29	26.50	-0.21	
Other Hispanic	13.06	12.45	0.61	
Non-Hispanic White	23.66	26.08	-2.42	
Non-Hispanic Black	30.67	26.50	4.17	
Other or multiracial	6.31	8.47	-2.16	
Average number of siblings of the focal child in the home	0.69	0.71	-0.01	0.791
Ability to speak English self-rated as "not very well" or "not at all" (%)	11.26	11.58	-0.31	0.816
Moved more than once during the past year (%)	17.40	19.37	-1.97	0.221
Economic circumstances (%)				
Food insecurity ^a	54.11	55.73	-1.63	0.431
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	60.39	58.93	1.46	0.475
Women, Infants, and Children Program	77.86	77.66	0.20	0.908
Temporary Assistance for Needy Families	19.17	19.88	-0.71	0.667
Disability insurance	15.72	17.85	-2.13	0.172
Maternal highest level of education				0.546
Less than a high school diploma or equivalent	40.40	41.79	-1.38	
High school diploma	33.98	31.83	2.15	
Some college or more	25.62	26.38	-0.77	
Maternal employment during the past three years				0.590
Not employed	19.88	20.67	-0.79	
Employed for 12 months or fewer	38.60	36.54	2.07	
Employed for more than 12 months	41.52	42.80	-1.28	
Currently taking or planning to take education or training classes	68.78	66.52	2.26	0.255
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	39.42	42.84	-3.42	0.094
Substance use before pregnancy (%)	29.89	30.04	-0.15	0.938
Average level of verbal abstract reasoning ^c	6.92	7.00	-0.08	0.488
Health status self-rated as "poor" or "fair" (%)	11.26	13.34	-2.09	0.125
Past behavioral health services (%)	18.45	21.24	-2.79	0.093

(continued)

Appendix Table B.2 (continued)

Characteristic	Program Group	Control Group	Difference	P-Value
Average level of mastery ^d	22.18	21.96	0.22	0.118
Smoked during the three months before pregnancy (%)	25.86	27.34	-1.48	0.419
Average body mass index	28.06	27.68	0.38	0.263
Intention to breastfeed (%)	87.10	82.93	4.17	0.029
Future childbearing intention (%)	12.90	12.76	0.14	0.923
Average perception of relationship quality with partner or spouse ^e	6.40	6.46	-0.06	0.214
Health insurance and access to care (%)				
Usual source of well-child care	93.65	91.39	2.26	0.204
Health insurance coverage for the mother	90.01	90.03	-0.02	0.989
Crime and intimate partner violence (%)				
Arrested during the past year	6.06	4.75	1.30	0.166
Maternal experience with physical or sexual violence ^f	7.19	7.89	-0.70	0.522
Maternal perpetration of physical violence ^f	16.74	17.32	-0.58	0.711
Maternal experience with battering ^g	5.52	4.93	0.59	0.524
Past domestic violence services	7.20	8.08	-0.88	0.426
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.06	5.13	-0.08	0.603
Parental verbal skills	2.82	2.85	-0.03	0.153
Parental lack of hostility	4.66	4.57	0.10	0.295
Home interior	6.89	6.87	0.03	0.705
Low level of maternal empathy ⁱ (%)	20.37	22.25	-1.88	0.268
Child characteristics				
Average age (months)	1.48	1.48	0.00	0.982
Sex (%)				0.600
Female	50.79	49.70	1.09	
Male	49.21	50.30	-1.09	
Poor health at birth ^j (%)	26.67	22.20	4.47	0.127
Involvement with Child Protective Services before study entry (%)	5.57	1.99	3.58	0.009
Average level of emotionality ^k	2.21	2.32	-0.11	0.103
Sample size (total = 2,332)	1,147	1,185		

(continued)

Appendix Table B.2 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASIII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

Appendix Table B.3. Comparison of Selected Baseline Characteristics Between Program and Control Groups Among Teacher Survey Respondents

Characteristic	Program Group	Control Group	Difference	P-Value
Maternal and household characteristics				
Average age (years)	23.80	24.28	-0.48	0.126
Pregnant (%)	62.14	58.72	3.43	0.204
Relationship status (%)				0.298
Married to the focal child's biological father	22.31	21.00	1.30	
Living with a partner or spouse	24.62	25.24	-0.62	
In a relationship but not living together	30.31	26.96	3.35	
Single	22.77	26.80	-4.03	
Race and ethnicity (%)				0.179
Mexican origin	27.12	24.81	2.31	
Other Hispanic	11.52	10.87	0.64	
Non-Hispanic White	24.09	29.86	-5.77	
Non-Hispanic Black	30.00	26.65	3.35	
Other or multiracial	7.27	7.81	-0.54	
Average number of siblings of the focal child in the home	0.71	0.74	-0.03	0.612
Ability to speak English self-rated as "not very well" or "not at all" (%)	9.52	11.17	-1.64	0.342
Moved more than once during the past year (%)	18.51	19.69	-1.18	0.588
Economic circumstances (%)				
Food insecurity ^a	51.59	55.06	-3.47	0.208
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	61.01	59.32	1.69	0.534
Women, Infants, and Children Program	80.58	76.73	3.84	0.090
Temporary Assistance for Needy Families	20.92	18.65	2.27	0.307
Disability insurance	16.31	18.79	-2.48	0.241
Maternal highest level of education				0.117
Less than a high school diploma or equivalent	37.23	42.28	-5.05	
High school diploma	37.08	32.25	4.83	
Some college or more	25.68	25.46	0.22	
Maternal employment during the past three years				0.113
Not employed	19.72	20.50	-0.77	
Employed for 12 months or fewer	39.45	34.01	5.44	
Employed for more than 12 months	40.83	45.50	-4.67	
Currently taking or planning to take education or training classes	68.79	64.83	3.96	0.135
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	37.78	43.16	-5.38	0.047
Substance use before pregnancy (%)	28.96	33.28	-4.32	0.092
Average level of verbal abstract reasoning ^c	6.98	7.09	-0.10	0.475
Health status self-rated as "poor" or "fair" (%)	10.86	13.76	-2.90	0.109
Past behavioral health services (%)	17.00	22.62	-5.62	0.011

(continued)

Appendix Table B.3 (continued)

Characteristic	Program Group	Control Group	Difference	P-Value
Average level of mastery ^d	22.17	22.03	0.15	0.432
Smoked during the three months before pregnancy (%)	27.16	31.07	-3.90	0.121
Average body mass index	27.85	27.96	-0.11	0.795
Intention to breastfeed (%)	88.04	84.10	3.94	0.117
Future childbearing intention (%)	13.37	12.66	0.70	0.717
Average perception of relationship quality with partner or spouse ^e	6.39	6.42	-0.03	0.715
Health insurance and access to care (%)				
Usual source of well-child care	91.63	92.57	-0.93	0.695
Health insurance coverage for the mother	89.23	90.51	-1.28	0.443
Crime and intimate partner violence (%)				
Arrested during the past year	6.23	4.77	1.46	0.246
Maternal experience with physical or sexual violence ^f	6.53	8.17	-1.64	0.256
Maternal perpetration of physical violence ^f	17.00	18.03	-1.03	0.624
Maternal experience with battering ^g	3.79	4.93	-1.14	0.315
Past domestic violence services	7.14	8.49	-1.34	0.366
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.15	5.12	0.03	0.873
Parental verbal skills	2.82	2.86	-0.05	0.104
Parental lack of hostility	4.76	4.50	0.27	0.027
Home interior	6.89	6.80	0.09	0.330
Low level of maternal empathy ⁱ (%)	21.75	20.95	0.80	0.722
Child characteristics				
Average age (months)	1.50	1.51	-0.01	0.930
Sex (%)				0.935
Female	50.30	50.08	0.23	
Male	49.70	49.92	-0.23	
Poor health at birth ^j (%)	29.03	24.24	4.79	0.222
Involvement with Child Protective Services before study entry (%)	5.58	3.42	2.16	0.273
Average level of emotionality ^k	2.25	2.34	-0.09	0.301
Sample size (total = 1,317)	663	654		

(continued)

Appendix Table B.3 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASIII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

BASELINE CHARACTERISTICS OF RESPONDENTS AND NONRESPONDENTS

Appendix Table B.4 compares the baseline characteristics of families who completed any part of the caregiver survey (respondents) with those of families who did not (nonrespondents). Appendix Table B.5 presents a similar comparison between families who completed any part of the direct assessments with those of families who did not. Appendix Table B.6 shows a similar comparison between families who had teachers respond to the teacher survey with families who did not. Differences between respondents and nonrespondents could point to a source of bias if effects differ with family characteristics. All tables show many differences between respondents and nonrespondents. Though the differences vary by the data collection instrument, in general, respondents were less likely to be pregnant at study entry, were more likely to be married to the focal child's biological father, were more likely to have been employed for longer, and more likely to have a high school education. A statistical test indicated that the baseline characteristics are collectively significantly different for respondents compared with nonrespondents (the p-value is less than 0.001 for all three data collection efforts).

Systematic differences in baseline characteristics between respondents and nonrespondents have been found in each of the MIHOPE follow-ups to date. These differences would be a source of bias only if different types of families saw different effects. To assess how likely it is that differences between respondents and nonrespondents contributed to bias in the effect estimates, Appendix G presents the effect estimates when outcomes are imputed for families who did not respond to follow-up data collection. See Appendix G for information about the extent to which imputed results differ from the main results, and Appendix F for a discussion of the extent to which estimated effects vary based on a set of family characteristics collected at baseline.

**Appendix Table B.4. Comparison of Selected Baseline Characteristics
Between Caregiver Survey Respondents and Nonrespondents**

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Maternal and household characteristics				
Average age (years)	24.02	23.15	0.87	0.000
Pregnant (%)	62.86	71.20	-8.35	0.000
Relationship status (%)				0.000
Married to the focal child's biological father	21.51	14.67	6.85	
Living with a partner or spouse	24.33	27.35	-3.02	
In a relationship but not living together	28.53	29.58	-1.05	
Single	25.63	28.40	-2.77	
Race and ethnicity (%)				0.000
Mexican origin	25.64	20.85	4.79	
Other Hispanic	13.00	11.64	1.37	
Non-Hispanic White	24.90	28.30	-3.41	
Non-Hispanic Black	28.77	27.94	0.83	
Other or multiracial	7.70	11.27	-3.58	
Average number of siblings of the focal child in the home	0.69	0.56	0.13	0.000
Ability to speak English self-rated as "not very well" or "not at all" (%)	10.75	8.67	2.08	0.029
Moved more than once during the past year (%)	18.27	23.37	-5.10	0.000
Economic circumstances (%)				
Food insecurity ^a	54.92	53.86	1.06	0.503
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	59.24	58.74	0.49	0.754
Women, Infants, and Children Program	77.33	70.65	6.69	0.000
Temporary Assistance for Needy Families	19.11	21.82	-2.70	0.038
Disability insurance	17.08	18.24	-1.16	0.345
Maternal highest level of education				0.009
Less than a high school diploma or equivalent	40.68	44.46	-3.78	
High school diploma	32.49	32.65	-0.15	
Some college or more	26.83	22.90	3.93	
Maternal employment during the past three years				0.006
Not employed	20.25	19.65	0.60	
Employed for 12 months or fewer	36.96	41.80	-4.83	
Employed for more than 12 months	42.79	38.56	4.23	
Currently taking or planning to take education or training classes	68.14	72.25	-4.11	0.006
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	40.92	44.09	-3.18	0.045
Substance use before pregnancy (%)	30.10	33.80	-3.71	0.013
Average level of verbal abstract reasoning ^c	7.00	6.88	0.12	0.132
Health status self-rated as "poor" or "fair" (%)	12.21	11.65	0.57	0.583
Past behavioral health services (%)	20.16	24.16	-3.99	0.003

(continued)

Appendix Table B.4 (continued)

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Average level of mastery ^d	22.09	22.02	0.07	0.514
Smoked during the three months before pregnancy (%)	26.81	33.25	-6.44	0.000
Average body mass index	27.86	26.63	1.23	0.000
Intention to breastfeed (%)	84.91	80.41	4.50	0.003
Future childbearing intention (%)	12.70	11.19	1.51	0.159
Average perception of relationship quality with partner or spouse ^e	6.42	6.42	0.00	0.941
Health insurance and access to care (%)				
Usual source of well-child care	92.16	93.07	-0.90	0.538
Health insurance coverage for the mother	90.26	92.55	-2.30	0.009
Crime and intimate partner violence (%)				
Arrested during the past year	5.40	7.28	-1.88	0.017
Maternal experience with physical or sexual violence ^f	7.77	6.32	1.45	0.073
Maternal perpetration of physical violence ^f	17.37	19.22	-1.86	0.134
Maternal experience with battering ^g	4.90	5.61	-0.72	0.319
Past domestic violence services	7.76	10.95	-3.20	0.001
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.10	4.96	0.14	0.293
Parental verbal skills	2.84	2.82	0.02	0.235
Parental lack of hostility	4.62	4.58	0.03	0.676
Home interior	6.88	6.99	-0.12	0.028
Low level of maternal empathy ⁱ (%)	20.99	23.93	-2.94	0.028
Child characteristics				
Average age (months)	1.44	1.42	0.03	0.784
Sex (%)				0.052
Female	50.21	47.07	3.14	
Male	49.79	52.93	-3.14	
Poor health at birth ⁱ (%)	24.38	26.91	-2.52	0.313
Involvement with Child Protective Services before study entry (%)	3.73	7.22	-3.50	0.013
Average level of emotionality ^k	2.27	2.30	-0.03	0.666
Sample size (total = 4,102)	2,442	1,660		

(continued)

Appendix Table B.4 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASIII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

**Appendix Table B.5. Comparison of Selected Baseline Characteristics
Between Direct Assessment Respondents and Nonrespondents**

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Maternal and household characteristics				
Average age (years)	24.09	23.12	0.97	0.000
Pregnant (%)	62.31	71.41	-9.11	0.000
Relationship status (%)				0.000
Married to the focal child's biological father	21.57	15.00	6.57	
Living with a partner or spouse	24.87	26.44	-1.58	
In a relationship but not living together	28.73	29.25	-0.51	
Single	24.82	29.31	-4.48	
Race and ethnicity (%)				0.000
Mexican origin	26.40	20.14	6.26	
Other Hispanic	12.75	12.06	0.69	
Non-Hispanic White	24.89	28.10	-3.21	
Non-Hispanic Black	28.55	28.27	0.28	
Other or multiracial	7.41	11.43	-4.03	
Average number of siblings of the focal child in the home	0.70	0.55	0.15	0.000
Ability to speak English self-rated as “not very well” or “not at all” (%)	11.42	7.95	3.47	0.000
Moved more than once during the past year (%)	18.40	22.88	-4.47	0.001
Economic circumstances (%)				
Food insecurity ^a	54.93	53.90	1.03	0.513
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	59.64	58.24	1.41	0.368
Women, Infants, and Children Program	77.75	70.50	7.26	0.000
Temporary Assistance for Needy Families	19.53	21.10	-1.57	0.221
Disability insurance	16.80	18.54	-1.74	0.154
Maternal highest level of education				0.225
Less than a high school diploma or equivalent	41.11	43.66	-2.55	
High school diploma	32.89	32.12	0.77	
Some college or more	26.01	24.22	1.79	
Maternal employment during the past three years				0.116
Not employed	20.28	19.64	0.63	
Employed for 12 months or fewer	37.55	40.72	-3.17	
Employed for more than 12 months	42.17	39.63	2.53	
Currently taking or planning to take education or training classes	67.62	72.68	-5.06	0.001
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	41.16	43.58	-2.42	0.123
Substance use before pregnancy (%)	29.97	33.73	-3.77	0.011
Average level of verbal abstract reasoning ^c	6.96	6.94	0.02	0.792
Health status self-rated as “poor” or “fair” (%)	12.32	11.54	0.77	0.449
Past behavioral health services (%)	19.87	24.30	-4.43	0.001

(continued)

Appendix Table B.5 (continued)

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Average level of mastery ^d	22.07	22.06	0.01	0.900
Smoked during the three months before pregnancy (%)	26.61	33.10	-6.49	0.000
Average body mass index	27.87	26.71	1.16	0.000
Intention to breastfeed (%)	85.00	80.60	4.40	0.003
Future childbearing intention (%)	12.83	11.11	1.72	0.106
Average perception of relationship quality with partner or spouse ^e	6.43	6.41	0.02	0.645
Health insurance and access to care (%)				
Usual source of well-child care	92.48	92.46	0.02	0.988
Health insurance coverage for the mother	90.02	92.73	-2.71	0.002
Crime and intimate partner violence (%)				
Arrested during the past year	5.39	7.16	-1.77	0.023
Maternal experience with physical or sexual violence ^f	7.54	6.72	0.82	0.310
Maternal perpetration of physical violence ^f	17.03	19.54	-2.51	0.041
Maternal experience with battering ^g	5.22	5.14	0.07	0.915
Past domestic violence services	7.65	10.90	-3.25	0.000
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.10	4.96	0.14	0.307
Parental verbal skills	2.83	2.83	0.00	0.773
Parental lack of hostility	4.61	4.60	0.02	0.833
Home interior	6.88	6.99	-0.11	0.042
Low level of maternal empathy ⁱ (%)	21.32	23.30	-1.98	0.134
Child characteristics				
Average age (months)	1.48	1.36	0.12	0.199
Sex (%)				0.060
Female	50.24	47.23	3.01	
Male	49.76	52.77	-3.01	
Poor health at birth ⁱ (%)	24.36	26.80	-2.44	0.323
Involvement with Child Protective Services before study entry (%)	3.72	7.04	-3.31	0.015
Average level of emotionality ^k	2.27	2.29	-0.03	0.653
Sample size (total = 4,102)	2,332	1,770		

(continued)

Appendix Table B.5 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASIII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

**Appendix Table B.6. Comparison of Selected Baseline Characteristics
Between Teacher Survey Respondents and Nonrespondents**

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Maternal and household characteristics				
Average age (years)	24.04	23.49	0.55	0.004
Pregnant (%)	60.44	68.98	-8.54	0.000
Relationship status (%)				0.008
Married to the focal child's biological father	21.66	17.36	4.30	
Living with a partner or spouse	24.92	25.84	-0.92	
In a relationship but not living together	28.65	29.10	-0.45	
Single	24.77	27.69	-2.93	
Race and ethnicity (%)				0.014
Mexican origin	25.97	22.62	3.35	
Other Hispanic	11.20	13.05	-1.85	
Non-Hispanic White	26.96	25.95	1.01	
Non-Hispanic Black	28.33	28.48	-0.15	
Other or multiracial	7.54	9.90	-2.36	
Average number of siblings of the focal child in the home	0.73	0.59	0.13	0.000
Ability to speak English self-rated as "not very well" or "not at all" (%)	10.34	9.70	0.63	0.540
Moved more than once during the past year (%)	19.10	20.91	-1.81	0.174
Economic circumstances (%)				
Food insecurity ^a	53.31	55.05	-1.74	0.299
Public assistance receipt during the past month				
Supplemental Nutrition Assistance Program	60.17	58.50	1.67	0.313
Women, Infants, and Children Program	78.67	72.71	5.96	0.000
Temporary Assistance for Needy Families	19.80	20.40	-0.60	0.658
Disability insurance	17.54	17.55	-0.02	0.990
Maternal highest level of education				0.062
Less than a high school diploma or equivalent	39.74	43.38	-3.64	
High school diploma	34.69	31.55	3.14	
Some college or more	25.57	25.07	0.50	
Maternal employment during the past three years				0.115
Not employed	20.11	19.96	0.15	
Employed for 12 months or fewer	36.75	39.95	-3.20	
Employed for more than 12 months	43.14	40.09	3.05	
Currently taking or planning to take education or training classes	66.80	71.23	-4.43	0.005
Maternal well-being				
Symptoms of depression or anxiety ^b (%)	40.46	43.03	-2.57	0.120
Substance use before pregnancy (%)	31.11	31.82	-0.71	0.651
Average level of verbal abstract reasoning ^c	7.04	6.91	0.12	0.160
Health status self-rated as "poor" or "fair" (%)	12.30	11.83	0.47	0.670
Past behavioral health services (%)	19.79	22.72	-2.93	0.031

(continued)

Appendix Table B.6 (continued)

Characteristic	Respondents	Nonrespondents	Difference	P-Value
Average level of mastery ^d	22.10	22.05	0.05	0.654
Smoked during the three months before pregnancy (%)	29.10	29.55	-0.45	0.767
Average body mass index	27.91	27.11	0.80	0.003
Intention to breastfeed (%)	86.13	81.63	4.49	0.004
Future childbearing intention (%)	13.01	11.65	1.36	0.239
Average perception of relationship quality with partner or spouse ^e	6.41	6.43	-0.02	0.602
Health insurance and access to care (%)				
Usual source of well-child care	92.12	92.69	-0.58	0.697
Health insurance coverage for the mother	89.86	91.81	-1.95	0.047
Crime and intimate partner violence (%)				
Arrested during the past year	5.50	6.46	-0.96	0.223
Maternal experience with physical or sexual violence ^f	7.34	7.12	0.22	0.799
Maternal perpetration of physical violence ^f	17.51	18.40	-0.89	0.486
Maternal experience with battering ^g	4.36	5.58	-1.22	0.088
Past domestic violence services	7.81	9.63	-1.82	0.051
Parenting				
Average quality of the home environment ^h				
Parental warmth	5.13	5.00	0.13	0.304
Parental verbal skills	2.84	2.83	0.01	0.552
Parental lack of hostility	4.62	4.60	0.02	0.840
Home interior	6.85	6.96	-0.12	0.042
Low level of maternal empathy ⁱ (%)	21.35	22.57	-1.21	0.379
Child characteristics				
Average age (months)	1.50	1.39	0.11	0.233
Sex (%)				0.281
Female	50.19	48.37	1.82	
Male	49.81	51.63	-1.82	
Poor health at birth ^j (%)	26.56	24.47	2.09	0.393
Involvement with Child Protective Services before study entry (%)	4.45	5.26	-0.80	0.523
Average level of emotionality ^k	2.30	2.27	0.03	0.639
Sample size (total = 4,102)	1,317	2,785		

(continued)

Appendix Table B.6 (continued)

SOURCES: Calculations based on the MIHOPE family baseline survey, the research team's baseline home observations, state birth records, state administrative child welfare records, and Medicaid enrollment data.

NOTES: Rounding may cause slight discrepancies in sums and differences.

Distributions may not add to 100 percent because of rounding.

To assess differences between the research groups, chi-square tests were used for categorical variables and two-tailed t-tests were used for continuous variables.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

^aFood insecurity is defined as whether in the past year the family either (1) sometimes or often worried about their food running out before they got money to buy more or (2) sometimes or often worried about the food they bought not lasting and they did not have money to get more.

^bMeasured using the Center for Epidemiologic Studies-Depression (CES-D) 10-item (Kohout et al., 1993) scale and Generalized Anxiety Disorder (GAD-7) 7-item (Spitzer et al., 2006) scale. A score of 8 or higher on the CES-D 10-item scale indicates clinically significant symptoms of depression. A score of 10 or higher on the GAD-7 indicates moderate or severe anxiety symptoms.

^cMeasured using the similarities subscale of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). Respondents who took the Spanish version of the survey took the equivalent subscale of the Escala de Inteligencia de Wechsler-Tercera Edición (EIWA-III) (Wechsler, 2008). Scores range from 1 to 19, with higher scores indicating a greater level of verbal abstract reasoning.

^dMeasured using the Pearlin Mastery Scale (Pearlin and Schooler, 1978). Mastery refers to the extent to which one perceives control and autonomy over various aspects of life. Scores range from 7 to 28, with higher scores indicating greater levels of mastery.

^eScores range from 1 to 7, with higher scores indicating that the mother is happier in her relationship.

^fMeasured using items from the Revised Conflict Tactics Scale (Straus et al., 2003). Women were considered to have perpetrated or experienced physical violence if they reported violent acts occurring with their current partners during the past year.

^gMeasured using a short form of the Women's Experience with Battering Scale (Smith et al., 1995).

^hMeasured using the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 2003).

ⁱEmpathy skills were measured using a subscale of the Adult Adolescent Parenting Inventory-2 (AAPI) (Bavolek and Keene, 1999). For English-speaking women, the cutoff score for low empathy was less than or equal to 32 for adolescents and less than or equal to 38 for adults. For Spanish-speaking women, the cutoff score for low empathy was less than or equal to 29 for adolescents and less than or equal to 28 for adults.

^jPoor health at birth is defined as the child weighing less than 5.5 pounds at birth, born three weeks premature, or spent time in the NICU.

^kMeasured using the 5-item emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity (EASII) Temperament Survey (Buss and Plomin, 1984). Scores range from 1 to 5, with higher scores indicating greater levels of emotionality.

APPENDIX

C

Estimated Effects

The focus of the kindergarten analysis presented in Chapter 3 is understanding how groups of outcomes collectively answer each research question by conducting omnibus tests to aid in interpretation (see Chapter 2 for more information on how to interpret the main results). Chapter 3 presented a limited set of information about effects for individual outcomes in Figures 3.2 through 3.9. Therefore, this appendix chapter provides additional detail about each estimate presented in those figures, presented by each of the pre-specified research questions.

The eight research questions are:

- Did home visiting affect outcomes that could be improved through direct interaction between parents and home visitors?
- Did home visiting affect maternal mental and behavioral health?
- Did home visiting affect parent-child interactions?
- Did home visiting affect conflict, violence, aggression, and maltreatment?
- Did home visiting affect families' economic circumstances?
- Did home visiting affect children's social-emotional functioning in the home context?
- Did home visiting affect children's social-emotional functioning in school settings?
- Did home visiting affect children's cognitive, language, and early math skills?

Box C.1 provides guidance on how to read the tables in this appendix.

Appendix Tables C.1 through C.8 supplement the figures presented in Chapter 3, and present estimates for the program and control group, the effect or the difference between the two groups, the effect size, the p-value, and the confidence interval for each individual outcome. (The figures in Chapter 3 present the effect sizes for each individual outcome from these tables.)

Additionally, Appendix Table C.9 presents estimated effects for quality of play during the semi-structured task and for public assistance receipt, since those outcomes are not featured in a research question.

Quality of play during semi-structured task is excluded from the proposed research questions because play is multi-dimensional, capturing children's cognitive, social, emotional, and physical well-being. For this reason, it does not fall neatly under any of the research questions. Further, it is measured via only one subscale of the Three-Bags Task that focuses on the child's play with objects (see Appendix A). Therefore, it was not elevated to its own research question.

The study team excluded public assistance receipt outcomes from all omnibus tests conducted because the direction of effects is not clear. Receipt may be positive or negative, depending on families' circumstances. For example, receiving public assistance may be a positive outcome for families who are eligible for support but did not previously know how to access it. On the other hand, not receiving public assistance may be a positive outcome for families whose incomes have risen past the income eligibility thresholds for these kinds of support.

BOX C.1

How to Read the Appendix Tables Showing Estimated Effects

The effects of evidence-based home visiting are estimated by comparing the outcomes of the program and control groups, after accounting for the background characteristics of the sample members. These appendix tables showing effects present a series of numbers that are helpful for interpreting the estimated effects of the home visiting programs. The first two columns of numbers show the average outcomes for the program and control groups. For example, the excerpt from Table C.1, below, shows that the average program group family reported reading to their child for 21.37 minutes per day in a typical week at the kindergarten follow-up, compared with 21.93 minutes on average for control group families.

Table C.1 (Excerpt). Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Average amount of reading to child per day in a typical week (minutes)	21.37	21.93	-0.56	-0.04	0.348	-1.55	0.43
Sample size (total = 4,102)	2,041	2,061					

The number in the “Difference (Effect)” column displays the estimated effect, or the difference between the average outcomes of the program group and the control group. In the table excerpt shown here, this difference is -0.56 average minutes of reading to a child per day in a typical week (21.37 in the program group minus 21.93 in the control group). Due to rounding, effects may not be equal to the difference in program and control group means presented.

The “Effect Size” column shows a measure of the estimated effect that is adjusted so that all outcomes have the same amount of variation. It is calculated by dividing the estimated effect by the standard deviation of the outcome in the study sample. The interpretation of an effect size will vary with the outcome and the context, so it is difficult to characterize the magnitude of effect sizes in general. A standard intelligence quotient (IQ) test has a standard deviation of 10, for example, so an effect size of 0.10 would represent a one-point change in IQ. For an outcome expressed as a percentage, such as the percentage of mothers with a subsequent pregnancy, an effect size of 0.10 would represent a change of about 3 percentage points to 5 percentage points in the outcome.

The “90% Confidence Interval” column is an estimate of the variability (or statistical imprecision) of the effects of the home visiting program. Specifically, this column shows that there is a 90 percent chance that the estimated effect from any given study would fall within the 90 percent confidence interval. For a specific effect (difference in means or percentages), a narrower confidence interval suggests a more precise estimate than a wider confidence interval (which indicates greater variability and thus greater uncertainty). Confidence intervals that do not contain zero, such as 1.5 to 2.5, or -2.0 to -1.0, indicate that the estimated effect is significantly different than zero at the 10 percent level of statistical significance.

Appendix Table C.1. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.92	23.76	0.16	0.05	0.341	-0.12	0.43
Perceived social support	19.54	18.94	0.60	0.12	0.013	0.20	0.99
Resource mobilization	15.27	15.30	-0.02	-0.01	0.894	-0.32	0.27
Parenting distress							
Parenting distress	8.88	8.91	-0.03	-0.01	0.835	-0.29	0.23
Parent-child relationship							
Parental warmth	5.94	6.01	-0.08	-0.04	0.335	-0.20	0.05
Parent-child dysfunctional interaction	9.20	9.56	-0.36	-0.09	0.028	-0.63	-0.09
Aggression toward child							
Frequency of psychological aggression during the past year	6.25	6.62	-0.37	-0.06	0.151	-0.78	0.05
Frequency of physical aggression during the past year (%)	3.28	3.51	-0.23	-0.01	0.762	-1.49	1.03
Behavior toward child during semi-structured task							
Parental sensitivity	4.67	4.61	0.06	0.06	0.178	-0.01	0.14
Parental positive regard	4.41	4.36	0.04	0.05	0.278	-0.02	0.11
Parental stimulation of cognitive development	4.38	4.35	0.03	0.03	0.468	-0.04	0.10
Parental intrusiveness	1.85	1.87	-0.02	-0.02	0.575	-0.09	0.04
Parental detachment	1.11	1.14	-0.03	-0.06	0.137	-0.06	0.00
Parental negative regard	1.17	1.18	-0.02	-0.03	0.476	-0.05	0.02
Parental support for learning and development							
Reads to child daily (%)	38.97	39.01	-0.04	0.00	0.983	-3.37	3.28
Average amount of reading to child per day in a typical week (minutes)	21.37	21.93	-0.56	-0.04	0.348	-1.55	0.43
Number of children's books in the home	51.51	47.80	3.71	0.06	0.093	0.08	7.35
Composite of in-home literacy activities	0.68	0.68	0.00	0.00	0.979	-0.02	0.02
Composite of in-home learning activities	0.61	0.61	0.01	0.03	0.580	-0.01	0.03
Percentage of days absent from school	8.56	8.33	0.24	0.03	0.669	-0.67	1.14
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.012.

Appendix Table C.2. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.92	23.76	0.16	0.05	0.341	-0.12	0.43
Perceived social support	19.54	18.94	0.60	0.12	0.013	0.20	0.99
Resource mobilization	15.27	15.30	-0.02	-0.01	0.894	-0.32	0.27
Parenting distress							
Parenting distress	8.88	8.91	-0.03	-0.01	0.835	-0.29	0.23
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	23.09	22.90	0.19	0.00	0.908	-2.55	2.94
Maternal substance use (%)							
Used illicit drugs	7.06	8.12	-1.06	-0.04	0.330	-2.85	0.73
Excessive drinking	18.28	17.54	0.74	0.02	0.638	-1.85	3.33
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.040.

Appendix Table C.3. Estimated Effects on Parent-Child Interactions at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Parent-child relationship							
Parental warmth	5.94	6.01	-0.08	-0.04	0.335	-0.20	0.05
Parent-child dysfunctional interaction	9.20	9.56	-0.36	-0.09	0.028	-0.63	-0.09
Aggression toward child							
Frequency of psychological aggression during the past year	6.25	6.62	-0.37	-0.06	0.151	-0.78	0.05
Frequency of physical aggression during the past year (%)	3.28	3.51	-0.23	-0.01	0.762	-1.49	1.03
Behavior toward child during semi-structured task							
Parental sensitivity	4.67	4.61	0.06	0.06	0.178	-0.01	0.14
Parental positive regard	4.41	4.36	0.04	0.05	0.278	-0.02	0.11
Parental stimulation of cognitive development	4.38	4.35	0.03	0.03	0.468	-0.04	0.10
Parental intrusiveness	1.85	1.87	-0.02	-0.02	0.575	-0.09	0.04
Parental detachment	1.11	1.14	-0.03	-0.06	0.137	-0.06	0.00
Parental negative regard	1.17	1.18	-0.02	-0.03	0.476	-0.05	0.02
Behavior toward parent during semi-structured task							
Child engagement of parent	5.03	5.01	0.02	0.03	0.578	-0.05	0.09
Child negativity toward parent	1.25	1.27	-0.02	-0.03	0.527	-0.06	0.03
Parental support for learning and development							
Reads to child daily (%)	38.97	39.01	-0.04	0.00	0.983	-3.37	3.28
Average amount of reading to child per day in a typical week (minutes)	21.37	21.93	-0.56	-0.04	0.348	-1.55	0.43
Number of children's books in the home	51.51	47.80	3.71	0.06	0.093	0.08	7.35
Composite of in-home literacy activities	0.68	0.68	0.00	0.00	0.979	-0.02	0.02
Composite of in-home learning activities	0.61	0.61	0.01	0.03	0.580	-0.01	0.03
Percentage of days absent from school	8.56	8.33	0.24	0.03	0.669	-0.67	1.14
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.065.

Appendix Table C.4. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Family conflict							
Family conflict	1.58	1.61	-0.03	-0.06	0.211	-0.07	0.01
Intimate partner violence (%)							
Maternal experience with physical violence	3.02	4.29	-1.27	-0.06	0.107	-2.57	0.03
Maternal perpetration of physical violence	8.04	7.30	0.74	0.03	0.505	-1.08	2.56
Maternal experience with battering	2.21	3.75	-1.54	-0.08	0.029	-2.71	-0.38
Aggression toward child							
Frequency of psychological aggression during the past year	6.25	6.62	-0.37	-0.06	0.151	-0.78	0.05
Frequency of physical aggression during the past year (%)	3.28	3.51	-0.23	-0.01	0.762	-1.49	1.03
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.61	0.73	-0.12	-0.01	0.713	-0.64	0.40
Any substantiated report of neglect since 15 months	2.55	2.23	0.32	0.02	0.590	-0.65	1.28
Any hospitalizations for injuries or ingestions since 15 months	2.29	2.16	0.14	0.01	0.818	-0.83	1.10
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.045.

Appendix Table C.5. Estimated Effects on Economic Circumstances at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Education, employment, and income							
Increase in education level since study entry (%)	29.04	30.80	-1.76	-0.04	0.317	-4.65	1.13
Receipt of high school diploma since study entry (%)	48.98	48.15	0.83	0.02	0.798	-4.53	6.20
Quarters employed in past year	2.51	2.39	0.11	0.07	0.040	0.02	0.21
Average quarterly earnings in the past year (\$)	3,683.37	3,440.45	242.93	0.06	0.084	11.58	474.27
Household income in the past year (\$)	31,336.17	31,658.03	-321.86	-0.01	0.822	-2,685.27	2,041.54
Material hardship							
Food insecurity (%)	20.25	23.72	-3.47	-0.08	0.070	-6.61	-0.33
Number of material hardships in the past year	1.33	1.43	-0.11	-0.08	0.097	-0.21	0.00
Number of moves in past year	0.44	0.43	0.01	0.01	0.753	-0.05	0.08
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.009.

Appendix Table C.6. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	17.51	17.38	0.13	0.04	0.387	-0.12	0.37
Behavior problems							
Externalizing behaviors	9.93	10.17	-0.25	-0.04	0.297	-0.64	0.14
Internalizing behaviors	5.06	5.33	-0.27	-0.07	0.103	-0.54	0.00
Emotional and behavioral self-regulation							
Emotional self-control	13.37	13.19	0.18	0.04	0.314	-0.11	0.47
Hyperactivity/inattention	7.88	8.14	-0.26	-0.06	0.129	-0.54	0.02
Attention/impulse control	2.58	2.55	0.03	0.06	0.139	0.00	0.07
Behavior toward parent during semi-structured task							
Child engagement of parent	5.03	5.01	0.02	0.03	0.578	-0.05	0.09
Child negativity toward parent	1.25	1.27	-0.02	-0.03	0.527	-0.06	0.03
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.040.

Appendix Table C.7. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	15.80	15.57	0.24	0.05	0.329	-0.16	0.64
Cooperation	12.54	12.36	0.18	0.04	0.454	-0.22	0.58
Assertive social skills	3.32	3.28	0.04	0.04	0.541	-0.07	0.16
Behavior problems							
Externalizing behaviors	8.04	8.30	-0.26	-0.03	0.543	-0.95	0.44
Internalizing behaviors	3.79	4.09	-0.30	-0.09	0.127	-0.63	0.02
Emotional and behavioral self-regulation							
Emotional self-control	14.51	14.05	0.46	0.09	0.136	-0.05	0.97
Hyperactivity/inattention	7.23	7.52	-0.29	-0.06	0.302	-0.76	0.17
Task orientation	3.30	3.24	0.06	0.05	0.339	-0.04	0.17
Frustration tolerance	3.55	3.46	0.09	0.08	0.169	-0.02	0.20
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.105.

Appendix Table C.8. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.94	-0.01	-0.08	0.104	-0.03	0.00
Cognitive flexibility - percent correct on valid trials	0.82	0.80	0.02	0.08	0.081	0.00	0.03
Short-term memory	3.92	3.90	0.02	0.02	0.562	-0.04	0.08
Language development							
Vocabulary knowledge	462.63	462.96	-0.33	-0.02	0.598	-1.37	0.71
Mathematics development							
Early numeracy and math skills	426.76	425.61	1.15	0.04	0.281	-0.61	2.92
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

An omnibus test that assessed the joint probability of observing the same or more favorable results if there were no effects resulted in a p-value of 0.219.

**Appendix Table C.9. Estimated Effects on Outcomes Not Included
in a Pre-Specified Research Question**

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Quality of play during semi-structured task							
Child quality of play	4.54	4.49	0.04	0.04	0.340	-0.03	0.12
Public assistance receipt during the past month (%)							
Supplemental Nutrition Assistance Program	52.30	49.50	2.80	0.06	0.139	-0.32	5.91
Women, Infants, and Children Program	28.13	29.43	-1.29	-0.03	0.489	-4.37	1.78
Temporary Assistance for Needy Families	8.52	8.20	0.32	0.01	0.772	-1.51	2.15
Disability insurance	9.62	8.76	0.85	0.03	0.447	-0.99	2.69
Medicaid	71.67	70.94	0.73	0.02	0.627	-1.75	3.22
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, Medicaid enrollment records, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

APPENDIX

D

Pandemic-Related Examinations of Effects

This appendix chapter presents findings related to the ways that families experienced the COVID-19 pandemic. Appendix Tables D.1 through D.8 present the estimated effects of the individual outcomes within the sub-areas represented in each of the eight pre-specified research questions, splitting the sample between those who were assessed before the pandemic and those who were assessed after the onset of the pandemic.

As described in Chapter 2, the “pre-pandemic sample” consists of kindergarteners who were assessed during the 2018-2019 school year (Cohort 1) and the 2019-2020 school year (Cohort 2). The study team concluded direct data collection with families in Cohort 2 in March 2020 as the United States began to experience and respond to the COVID-19 pandemic. The “pandemic sample” consists of kindergarteners (Cohort 4) and first graders (Cohort 3) who were assessed during the 2021-2022 school year, when schools reopened and children largely went back to school in-person around the country.

The analysis by timing of data collection examined whether the estimated effects differed based on whether the data were collected before the pandemic or after the onset of the pandemic.¹ To do this, the analysis split the sample based on timing of data collection and impacts were estimated. The analysis then examined whether the effects for the samples split by timing were statistically different from each other in an “across-group” analysis. In other words, the “across-group analysis” examined if there were statistically significant differences in the estimated effects for each individual outcome between the pre-pandemic and pandemic samples. The p-value of that statistical test is shown in the last column of each table. The p-value indicates the probability of finding differences in effects at least as large as those shown in the table if there were no true differences across the samples based on the timing of their data collection.

The tables also show the results of a “within-group” analysis. The asterisks in the tables represent the p-value of the statistical test assessing whether home visiting had a statistically significant effect within a data collection time period (for example, whether home visiting had a statistically significant effect *within* the pre-pandemic period).

As described in Chapters 3 and 4, the study team found that in general, the effects of home visiting did not differ based on the timing of data collection. Because of this, the data are pooled across the two time points and the main effects in Chapter 3 are estimated using the full sample. Although the main results presented in Chapter 3 use the full sample, results from the analyses presented in this appendix are used in Chapters 3 and 4 to contextualize the main results.

1. There is overlap between this sample split and the sample split conducted for examination by grade. In the sample assessed after the onset of the pandemic, 87.3 percent of children were first graders, while 12.7 percent were kindergarteners.

Appendix Table D.1. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.93	23.80	0.13	23.87	23.70	0.18	0.900
Perceived social support	19.57	18.81	0.75 ***	19.42	19.28	0.14	0.266
Resource mobilization	15.30	15.27	0.03	15.34	15.20	0.14	0.807
Parenting distress							
Parenting distress	8.88	8.97	-0.09	8.84	8.83	0.01	0.795
Parent-child relationship							
Parental warmth	6.03	6.11	-0.08	5.71	5.68	0.03	0.580
Parent-child dysfunctional interaction	9.25	9.47	-0.22	9.14	9.72	-0.58 *	0.360
Aggression toward child							
Frequency of psychological aggression during the past year	6.41	6.62	-0.21	5.81	6.63	-0.82	0.316
Frequency of physical aggression during the past year (%)	3.69	4.17	-0.47	2.01	2.02	-0.01	0.767
Behavior toward child during semi-structured task							
Parental sensitivity	4.66	4.61	0.05	4.74	4.58	0.16 *	0.250
Parental positive regard	4.51	4.49	0.02	4.14	4.01	0.13	0.249
Parental stimulation of cognitive development	4.38	4.36	0.01	4.36	4.31	0.04	0.736
Parental intrusiveness	1.90	1.91	-0.01	1.72	1.75	-0.03	0.870
Parental detachment	1.11	1.13	-0.02	1.10	1.13	-0.02	0.985
Parental negative regard	1.18	1.20	-0.02	1.13	1.14	0.00	0.699

(continued)

Appendix Table D.1 (continued)

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development							
Reads to child daily (%)	41.43	42.24	-0.81	31.80	31.71	0.09	0.848
Average amount of reading to child per day in a typical week (minutes)	21.47	21.40	0.07	21.04	23.31	-2.27 *	0.113
Number of children's books in the home	49.75	46.57	3.18	56.62	50.32	6.30	0.538
Composite of in-home literacy activities	0.70	0.70	0.00	0.64	0.65	-0.01	0.930
Composite of in-home learning activities	0.62	0.62	0.00	0.59	0.58	0.02	0.653
Percentage of days absent from school	7.95	7.29	0.66	9.81	10.18	-0.37	0.426
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.2. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.93	23.80	0.13	23.87	23.70	0.18	0.900
Perceived social support	19.57	18.81	0.75 ***	19.42	19.28	0.14	0.266
Resource mobilization	15.30	15.27	0.03	15.34	15.20	0.14	0.807
Parenting distress							
Parenting distress	8.88	8.97	-0.09	8.84	8.83	0.01	0.795
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	22.91	22.76	0.16	23.58	23.21	0.37	0.958
Maternal substance use (%)							
Used illicit drugs	6.15	8.51	-2.35 *	9.48	7.06	2.43	0.069
Excessive drinking	18.29	15.92	2.37	19.04	20.68	-1.64	0.304
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.3. Estimated Effects on Parent-Child Interactions at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	6.03	6.11	-0.08	5.71	5.68	0.03	0.580
Parent-child dysfunctional interaction	9.25	9.47	-0.22	9.14	9.72	-0.58 *	0.360
Aggression toward child							
Frequency of psychological aggression during the past year	6.41	6.62	-0.21	5.81	6.63	-0.82	0.316
Frequency of physical aggression during the past year (%)	3.69	4.17	-0.47	2.01	2.02	-0.01	0.767
Behavior toward child during semi-structured task							
Parental sensitivity	4.66	4.61	0.05	4.74	4.58	0.16 *	0.250
Parental positive regard	4.51	4.49	0.02	4.14	4.01	0.13	0.249
Parental stimulation of cognitive development	4.38	4.36	0.01	4.36	4.31	0.04	0.736
Parental intrusiveness	1.90	1.91	-0.01	1.72	1.75	-0.03	0.870
Parental detachment	1.11	1.13	-0.02	1.10	1.13	-0.02	0.985
Parental negative regard	1.18	1.20	-0.02	1.13	1.14	0.00	0.699
Behavior toward parent during semi-structured task							
Child engagement of parent	5.07	5.08	-0.01	4.86	4.88	-0.02	0.877
Child negativity toward parent	1.26	1.29	-0.03	1.21	1.23	-0.02	0.875
Parental support for learning and development							
Reads to child daily (%)	41.43	42.24	-0.81	31.80	31.71	0.09	0.848
Average amount of reading to child per day in a typical week (minutes)	21.47	21.40	0.07	21.04	23.31	-2.27 *	0.113
Number of children's books in the home	49.75	46.57	3.18	56.62	50.32	6.30	0.538
Composite of in-home literacy activities	0.70	0.70	0.00	0.64	0.65	-0.01	0.930
Composite of in-home learning activities	0.62	0.62	0.00	0.59	0.58	0.02	0.653
Percentage of days absent from school	7.95	7.29	0.66	9.81	10.18	-0.37	0.426
Sample size (total = 4,102)	1,353	1,358		688	703		

(continued)

Appendix Table D.3 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.4. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.59	1.62	-0.03	1.57	1.59	-0.02	0.887
Intimate partner violence (%)							
Maternal experience with physical violence	3.23	4.52	-1.29	2.82	3.41	-0.58	0.694
Maternal perpetration of physical violence	8.64	6.99	1.65	7.49	7.10	0.39	0.629
Maternal experience with battering	2.33	3.75	-1.42	2.26	3.38	-1.13	0.858
Aggression toward child							
Frequency of psychological aggression during the past year	6.41	6.62	-0.21	5.81	6.63	-0.82	0.316
Frequency of physical aggression during the past year (%)	3.69	4.17	-0.47	2.01	2.02	-0.01	0.767
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.19	1.07	-0.88 **	1.30	0.23	1.07 *	0.007
Any substantiated report of neglect since 15 months	2.41	1.77	0.63	2.96	2.96	0.00	0.645
Any hospitalizations for injuries or ingestions since 15 months	2.34	1.88	0.46	2.22	2.66	-0.44	0.526
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.5. Estimated Effects on Economic Circumstances at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	29.01	30.73	-1.72	27.82	32.17	-4.35	0.535
Receipt of high school diploma since study entry (%)	48.65	48.30	0.35	48.21	49.23	-1.02	0.874
Quarters employed in past year	2.50	2.42	0.08	2.50	2.36	0.13	0.651
Average quarterly earnings in the past year (\$)	3,404.46	3,250.68	153.78	4,228.20	3,801.91	426.29	0.398
Household income in the past year (\$)	29,252.42	29,582.29	-329.87	35,883.07	37,222.60	-1,339.53	0.790
Material hardship							
Food insecurity (%)	21.80	24.77	-2.98	16.95	20.68	-3.73	0.872
Number of material hardships in the past year	1.40	1.49	-0.10	1.14	1.29	-0.15	0.685
Number of moves in past year	0.48	0.49	-0.01	0.38	0.29	0.08	0.288
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure’s data source and the frequency of missing values within that data source.

**Appendix Table D.6. Estimated Effects on Children's Social-Emotional Functioning
in the Home Context at Kindergarten, by Timing of Data Collection**

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.49	17.37	0.12	17.47	17.49	-0.02	0.688
Behavior problems							
Externalizing behaviors	10.02	10.41	-0.39	9.84	9.41	0.43	0.123
Internalizing behaviors	5.05	5.42	-0.36 *	5.17	5.01	0.17	0.165
Emotional and behavioral self-regulation							
Emotional self-control	13.38	13.02	0.36 *	13.17	13.79	-0.61 *	0.020
Hyperactivity/inattention	7.90	8.23	-0.33	7.99	7.76	0.22	0.154
Attention/impulse control	2.55	2.51	0.04	2.66	2.68	-0.02	0.227
Behavior toward parent during semi-structured task							
Child engagement of parent	5.07	5.08	-0.01	4.86	4.88	-0.02	0.877
Child negativity toward parent	1.26	1.29	-0.03	1.21	1.23	-0.02	0.875
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.7. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	15.65	15.15	0.51 *	16.56	16.87	-0.30	0.227
Cooperation	12.36	11.99	0.37	13.41	13.48	-0.07	0.496
Assertive social skills	3.24	3.18	0.06	3.68	3.57	0.11	0.801
Behavior problems							
Externalizing behaviors	8.19	8.94	-0.75	6.95	6.62	0.33	0.330
Internalizing behaviors	3.76	4.23	-0.47 **	3.71	3.74	-0.02	0.394
Emotional and behavioral self-regulation							
Emotional self-control	14.31	13.69	0.62 *	15.60	15.04	0.56	0.944
Hyperactivity/inattention	7.34	7.97	-0.62 *	6.40	6.32	0.08	0.357
Task orientation	3.27	3.18	0.09	3.50	3.42	0.08	0.954
Frustration tolerance	3.53	3.37	0.15 **	3.69	3.67	0.02	0.459
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table D.8. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Timing of Data Collection

Outcome	Pre-Pandemic			Pandemic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.91	0.93	-0.02 *	0.97	0.96	0.01	0.077
Cognitive flexibility - percent correct on valid trials	0.80	0.78	0.02 *	0.87	0.87	-0.01	0.198
Short-term memory	3.90	3.86	0.04	3.97	4.04	-0.07	0.235
Language development							
Vocabulary knowledge	460.63	460.57	0.06	467.67	469.98	-2.31 **	0.079
Mathematics development							
Early numeracy and math skills	421.22	419.27	1.95 *	441.02	444.06	-3.04	0.034
Sample size (total = 4,102)	1,353	1,358		688	703		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by timing of data collection control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by timing of data collection was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

EARLY PANDEMIC EXPERIENCES OF MIHOPE FAMILIES

As described in Chapter 4, the study team implemented new virtual data collection efforts during the 2020-2021 school year to enhance understanding of how families in MIHOPE were experiencing the pandemic, including a brief web survey that was administered to families in all cohorts in September and October 2020.

Using the measures of families' economic circumstances and maternal well-being created from the web survey data, the study team examined whether early pandemic experiences were substantively different for MIHOPE families in the program group as compared with families in the control group.

Appendix Table D.9 shows the results of this examination. Based on the web survey measures, the study team did not find evidence of substantive differences between the early pandemic experiences of MIHOPE program group families and control group families.

Appendix Table D.9. Estimated Effects on Select Outcomes During the COVID-19 Pandemic

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Economic circumstances							
Working for pay (%)	53.47	53.35	0.12	0.00	0.969	-4.77	5.00
Food insecurity (%)	43.34	42.97	0.37	0.01	0.900	-4.45	5.19
Number of hardships since the start of the coronavirus outbreak	1.46	1.53	-0.07	-0.05	0.368	-0.21	0.06
Public assistance receipt in the past two months (%)							
Supplemental Nutrition Assistance Program	58.33	58.70	-0.37	-0.01	0.890	-4.78	4.04
Disability insurance	9.03	6.97	2.05	0.08	0.201	-0.59	4.70
Temporary Assistance for Needy Families	9.01	9.18	-0.18	-0.01	0.920	-3.05	2.70
Women, Infants, and Children Program	28.22	27.80	0.41	0.01	0.879	-4.06	4.89
Maternal well-being							
Exhibits depressive symptoms (%)	49.71	46.59	3.12	0.06	0.315	-1.99	8.23
Resource mobilization	12.93	12.94	-0.01	0.00	0.972	-0.42	0.41
Mastery	22.10	22.03	0.07	0.02	0.777	-0.33	0.46
Sample size (total = 3,411)	1,692	1,719					

SOURCE: Calculations based on the MIHOPE COVID-19 survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

APPENDIX

E

Grade Differences in Estimated Effects

This appendix chapter presents findings examining differences in effects based on whether the children were in kindergarten or first grade at the time of the kindergarten follow-up. Appendix Tables E.1 through E.8 present the estimated effects of the individual outcomes within the sub-areas represented in each of the eight pre-specified research questions, splitting the sample between those who were assessed in kindergarten and those who were assessed in first grade.

The analysis by grade examined whether the estimated effects differed based on whether the data were collected during the children’s kindergarten year or their first-grade year.¹ To do this, the analysis split the sample based on grade and impacts were estimated. The analysis then examined whether the effects for the samples split by grade were statistically different from each other in an “across-group” analysis. In other words, the “across-group analysis” examined if there were statistically significant differences in the estimated effects for each individual outcome between the kindergarten and first-grade samples. The p-value of that statistical test is shown in the last column of each table. The p-value indicates the probability of finding differences in effects at least as large as those shown in the table if there were no true differences across the samples split by grade.

The tables also show the results of a “within-group” analysis. The asterisks in the tables represent the p-value of the statistical test assessing whether home visiting had a statistically significant effect within a sample based on grade (for example, whether home visiting had a statistically significant effect *within* the first-grade sample).

Results from the analyses presented in this appendix are used in Chapter 3 to contextualize the main results.

1. There is overlap between this sample split and the sample split conducted for examination by timing of data collection. In the sample assessed after the onset of the pandemic, 87.3 percent of children were first graders, while 12.7 percent were kindergarteners.

Appendix Table E.1. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.93	23.79	0.14	23.86	23.77	0.09	0.888
Perceived social support	19.56	18.79	0.76 ***	19.39	19.50	-0.11	0.148
Resource mobilization	15.32	15.25	0.07	15.34	15.28	0.06	0.976
Parenting distress							
Parenting distress	8.91	8.96	-0.04	8.75	8.83	-0.08	0.936
Parent-child relationship							
Parental warmth	6.01	6.10	-0.09	5.75	5.65	0.11	0.344
Parent-child dysfunctional interaction	9.23	9.52	-0.29	9.24	9.62	-0.38	0.829
Aggression toward child							
Frequency of psychological aggression during the past year	6.30	6.64	-0.34	6.16	6.57	-0.41	0.907
Frequency of physical aggression during the past year (%)	3.56	4.19	-0.64	2.47	1.47	1.00	0.317
Behavior toward child during semi-structured task							
Parental sensitivity	4.67	4.61	0.06	4.73	4.59	0.14	0.456
Parental positive regard	4.49	4.45	0.04	4.16	4.07	0.08	0.662
Parental stimulation of cognitive development	4.38	4.35	0.03	4.41	4.30	0.11	0.434
Parental intrusiveness	1.89	1.91	-0.02	1.76	1.70	0.05	0.449
Parental detachment	1.11	1.13	-0.02	1.10	1.15	-0.04	0.627
Parental negative regard	1.18	1.20	-0.02	1.13	1.14	-0.01	0.864

(continued)

Appendix Table E.1 (continued)

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development							
Reads to child daily (%)	41.10	41.23	-0.13	33.04	31.90	1.14	0.799
Average amount of reading to child per day in a typical week (minutes)	21.48	21.34	0.14	21.15	23.69	-2.54 *	0.104
Number of children's books in the home	49.31	46.27	3.04	58.73	52.81	5.92	0.604
Composite of in-home literacy activities	0.70	0.69	0.00	0.65	0.66	-0.01	0.801
Composite of in-home learning activities	0.62	0.62	0.00	0.58	0.58	0.00	0.975
Percentage of days absent from school	7.94	7.60	0.33	9.74	9.52	0.21	0.926
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.2. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.93	23.79	0.14	23.86	23.77	0.09	0.888
Perceived social support	19.56	18.79	0.76 ***	19.39	19.50	-0.11	0.148
Resource mobilization	15.32	15.25	0.07	15.34	15.28	0.06	0.976
Parenting distress							
Parenting distress	8.91	8.96	-0.04	8.75	8.83	-0.08	0.936
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	23.00	22.88	0.12	23.65	22.39	1.25	0.791
Maternal substance use (%)							
Used illicit drugs	6.39	8.78	-2.39 *	10.16	5.50	4.66 *	0.010
Excessive drinking	17.64	16.25	1.39	20.15	21.52	-1.37	0.518
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.3. Estimated Effects on Parent-Child Interactions at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	6.01	6.10	-0.09	5.75	5.65	0.11	0.344
Parent-child dysfunctional interaction	9.23	9.52	-0.29	9.24	9.62	-0.38	0.829
Aggression toward child							
Frequency of psychological aggression during the past year	6.30	6.64	-0.34	6.16	6.57	-0.41	0.907
Frequency of physical aggression during the past year (%)	3.56	4.19	-0.64	2.47	1.47	1.00	0.317
Behavior toward child during semi-structured task							
Parental sensitivity	4.67	4.61	0.06	4.73	4.59	0.14	0.456
Parental positive regard	4.49	4.45	0.04	4.16	4.07	0.08	0.662
Parental stimulation of cognitive development	4.38	4.35	0.03	4.41	4.30	0.11	0.434
Parental intrusiveness	1.89	1.91	-0.02	1.76	1.70	0.05	0.449
Parental detachment	1.11	1.13	-0.02	1.10	1.15	-0.04	0.627
Parental negative regard	1.18	1.20	-0.02	1.13	1.14	-0.01	0.864
Behavior toward parent during semi-structured task							
Child engagement of parent	5.07	5.06	0.01	4.87	4.91	-0.03	0.716
Child negativity toward parent	1.26	1.28	-0.03	1.22	1.23	-0.01	0.775
Parental support for learning and development							
Reads to child daily (%)	41.10	41.23	-0.13	33.04	31.90	1.14	0.799
Average amount of reading to child per day in a typical week (minutes)	21.48	21.34	0.14	21.15	23.69	-2.54 *	0.104
Number of children's books in the home	49.31	46.27	3.04	58.73	52.81	5.92	0.604
Composite of in-home literacy activities	0.70	0.69	0.00	0.65	0.66	-0.01	0.801
Composite of in-home learning activities	0.62	0.62	0.00	0.58	0.58	0.00	0.975
Percentage of days absent from school	7.94	7.60	0.33	9.74	9.52	0.21	0.926
Sample size (total = 4,051)	1,435	1,423		584	609		

(continued)

Appendix Table E.3 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.4. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.59	1.62	-0.03	1.57	1.58	-0.01	0.670
Intimate partner violence (%)							
Maternal experience with physical violence	3.28	4.58	-1.29	2.00	2.92	-0.93	0.830
Maternal perpetration of physical violence	8.52	7.12	1.40	7.81	6.33	1.48	0.977
Maternal experience with battering	2.60	3.68	-1.08	1.28	3.97	-2.69 *	0.348
Aggression toward child							
Frequency of psychological aggression during the past year	6.30	6.64	-0.34	6.16	6.57	-0.41	0.907
Frequency of physical aggression during the past year (%)	3.56	4.19	-0.64	2.47	1.47	1.00	0.317
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.19	1.00	-0.81 **	1.43	0.38	1.06	0.022
Any substantiated report of neglect since 15 months	2.33	1.64	0.69	2.83	3.60	-0.76	0.335
Any hospitalizations for injuries or ingestions since 15 months	2.42	2.02	0.40	1.71	2.56	-0.85	0.365
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.5. Estimated Effects on Economic Circumstances at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	28.25	30.65	-2.40	29.26	32.12	-2.86	0.918
Receipt of high school diploma since study entry (%)	47.53	48.11	-0.58	52.30	48.90	3.40	0.664
Quarters employed in past year	2.49	2.41	0.08	2.53	2.40	0.13	0.648
Average quarterly earnings in the past year (\$)	3,414.47	3,270.24	144.23	4,306.55	3,824.09	482.46	0.314
Household income in the past year (\$)	29,172.79	29,657.75	-484.96	37,612.06	38,020.30	-408.23	0.984
Material hardship							
Food insecurity (%)	21.25	24.64	-3.38	17.20	20.73	-3.53	0.977
Number of material hardships in the past year	1.38	1.49	-0.10	1.13	1.32	-0.18	0.614
Number of moves in past year	0.47	0.48	-0.02	0.40	0.28	0.13	0.123
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.6. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.47	17.36	0.11	17.56	17.54	0.02	0.805
Behavior problems							
Externalizing behaviors	10.00	10.38	-0.38	9.75	9.47	0.28	0.244
Internalizing behaviors	5.06	5.41	-0.35 *	5.11	5.01	0.09	0.267
Emotional and behavioral self-regulation							
Emotional self-control	13.33	13.04	0.29	13.38	13.81	-0.43	0.102
Hyperactivity/inattention	7.89	8.22	-0.33	7.91	7.77	0.15	0.254
Attention/impulse control	2.55	2.51	0.04 *	2.65	2.71	-0.06	0.031
Behavior toward parent during semi-structured task							
Child engagement of parent	5.07	5.06	0.01	4.87	4.91	-0.03	0.716
Child negativity toward parent	1.26	1.28	-0.03	1.22	1.23	-0.01	0.775
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.7. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	15.68	15.12	0.55 *	16.57	17.27	-0.70	0.075
Cooperation	12.45	12.06	0.39	12.84	13.69	-0.85	0.097
Assertive social skills	3.25	3.18	0.07	3.68	3.65	0.04	0.882
Behavior problems							
Externalizing behaviors	8.11	8.79	-0.68	7.84	6.24	1.60	0.080
Internalizing behaviors	3.76	4.23	-0.47 **	3.82	3.59	0.23	0.227
Emotional and behavioral self-regulation							
Emotional self-control	14.43	13.73	0.69 *	14.92	15.43	-0.52	0.227
Hyperactivity/inattention	7.29	7.86	-0.57 *	7.01	6.01	1.00	0.077
Task orientation	3.28	3.19	0.10	3.40	3.49	-0.08	0.375
Frustration tolerance	3.54	3.39	0.15 **	3.56	3.78	-0.23	0.053
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table E.8. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Grade

Outcome	Kindergarten			First Grade			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.91	0.93	-0.02 *	0.97	0.96	0.01	0.042
Cognitive flexibility - percent correct on valid trials	0.80	0.78	0.02	0.88	0.88	0.00	0.335
Short-term memory	3.88	3.85	0.03	4.06	4.10	-0.04	0.458
Language development							
Vocabulary knowledge	460.85	460.93	-0.08	468.45	470.39	-1.94	0.201
Mathematics development							
Early numeracy and math skills	421.65	419.82	1.83	442.80	446.47	-3.67 *	0.026
Sample size (total = 4,051)	1,435	1,423		584	609		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Effects by grade control for evidence-based model to account for differences in the distribution of the evidence-based models within groups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

P-value for differences by grade was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

APPENDIX

F

Subgroup Differences in Estimated Effects, by Family Characteristics

This appendix chapter presents an exploratory analysis examining estimated effects for eight pre-specified subgroups of family characteristics. Seven of these subgroups are defined using characteristics measured at baseline when the women entered the study. The eighth is defined using information about mothers' adverse childhood experiences (ACEs) that was gathered on the kindergarten caregiver survey. Appendix A describes the subgroup construction.

These subgroups are defined by the following family characteristics. For the remainder of this appendix chapter, the term subgroup in the kindergarten analysis refers to one or more of these characteristics:

- Mother's level of psychological resources
- Mother's level of emotional functioning
- Presence of intimate partner violence between mother and partner
- Mother's number of adverse childhood experiences (ACEs)
- Mother's number of demographic risk factors
- Parity
- Child's gestational age at enrollment
- Mother's race and ethnicity

The definitions of subgroups used in previous studies of home visiting vary widely. With the exception of mother's number of ACEs, seven subgroups in the list above were selected for examination in the 15-month follow-up because they reflect characteristics that were often used to define subgroups in these previous studies, and that were likely to have policy or program implications if it emerged that home visiting had different effects among the subgroups defined by those characteristics.

The 15-month follow-up analysis examined subgroup differences for only the 12 confirmatory outcomes featured in that report.¹ That analysis found that effects on family outcomes do not vary much by family characteristics, suggesting that home visiting is not having larger effects for some types of families compared with others. Across the 84 subgroup comparisons examined in the 15-month follow-up (7 subgroups by 12 confirmatory outcomes), only eight differences were statistically significant, fewer than would be expected if the results were due to chance. After adjusting for multiple comparisons, only one sta-

1. Outcomes were designated as confirmatory based on prior evidence that consistently found positive effects on that outcome, the policy relevance of the outcome, and the quality of the tools available to measure those outcomes.

tistically significant result remained: home visiting had different effects on the number of Medicaid-paid well-child visits among mothers of different races and ethnicities.²

Despite the few statistically significant differences for these subgroups at the 15-month follow-up, the same subgroups were selected to be examined at the kindergarten follow-up to maintain continuity in the design of this analysis.³ The eighth subgroup—based on the mother’s number of ACEs, a characteristic examined at kindergarten—was added because research shows that the risk for a host of poor health and well-being outcomes increases as the number of ACEs increases.⁴

ANALYSIS OF SUBGROUP DIFFERENCES

The subgroup analysis follows the same organizational framework as the main kindergarten analysis, examining groups of outcomes organized under the eight pre-specified research questions, though no omnibus tests were conducted. This appendix chapter explores whether there are overall patterns of effects present for each subgroup, defined by the family characteristics listed above. This involved doing an across-group analysis for each subgroup and a within-group analysis when relevant. This is explained below.

As pre-specified in the analysis plan, the subgroup analysis first examined whether the estimated effects on individual outcomes (grouped by research question) differed across any of the *subgroup categories* within each of the eight subgroups. To do this, the analysis split the sample for each subgroup into its subgroup categories (for example, the subgroup analysis defined by the characteristic of parity split the sample into categories based on whether they were mothers with prior children or first-time mothers) and effects for each individual outcome in each research question were estimated.

Second, the analysis examined whether the effects for the subgroup categories were statistically different from each other—referred to here as an “across-group” analysis. Continuing the example, an across-group analysis of the subgroup defined by the characteristic of parity examined if there were statistically significant differences in the estimated effects for each individual outcome between the subgroup categories of mothers with prior children and first-time mothers.

Third, when the difference in estimated effects across the subgroup categories (as determined in the across-group analysis) was statistically significant for more than 10 percent of the outcomes included in that research question, the study team then reviewed the results

2. Michalopoulos et al. (2019).

3. The MIHOPE 15-month analysis plan discusses how the study team chose the subgroups at the 15-month follow-up and how the analysis would be conducted. That analysis plan was reviewed by an advisory committee to the Secretary of Health and Human Services.

4. For more information, see Faucetta et al. (2020).

to determine whether there was a pattern of effects to interpret *within* a particular subgroup category. This is referred to here as a “within-group” analysis. For example, if one or more outcomes had a statistically significant difference in the estimates in the across-group analysis for parity, the study team reviewed the findings to determine if there was a pattern of statistically significant effects for a particular subgroup category (that is, whether effects differed for mothers with prior children compared with first-time mothers). The study team considered the results of the within-group analyses for each research question to determine if there was a consistent pattern across the research questions.

However, if the total number of statistically significant differences for each subgroup represented 10 percent or less of the outcomes in the across-group analysis, the study team did not interpret the findings since that amount represents too few outcomes to detect meaningful patterns; in that situation, differences in effects could be based on sampling error alone. Further, the reader should not interpret any within-group effects present unless there is an across-group statistically significant finding. When there is a statistically significant within-group effect but no across-group significant finding, a statistically significant finding in one group but not the other could be driven by issues with precision and not having enough power to detect effects due to sample sizes for that group.

FINDINGS

This section first presents the distribution of families in each of the eight subgroups and their respective categories (see Appendix Table F.1). Appendix A describes how the subgroup categories are defined.

The remainder of this section shows detailed results for the eight subgroups defined using each of the characteristics listed above, by the outcomes featured in each research question (see Appendix Tables F.2 through F.65). For each subgroup category, the set of tables shows program and control group levels and estimated effects. The last column of each table shows the p-value of the statistical test assessing whether home visiting had different effects across the subgroup categories (the across-group analysis). The p-value indicates the probability of finding differences in effects at least as large as those shown in the table if there were no true differences across the subgroup categories.

The asterisks in the tables represent the p-value of the statistical test assessing whether home visiting had effects that were statistically significantly different for the program and control groups within that subgroup category (the within-group analysis).

Distribution of Families by Subgroup Characteristic and Categories

Appendix Table F.1 shows the distribution of families in the subgroups defined using each of the eight characteristics listed above, overall and in the program and control groups.

Appendix Table F.1. MIHOPE Family Characteristics Used to Define Subgroups

Characteristic (%)	Program Group	Control Group	Total	P-Value
Mother's level of psychological resources				0.113
Higher (above median)	53.7	51.2	52.5	
Lower (at or below median)	46.3	48.8	47.5	
Mother's level of emotional functioning				0.848
Higher	41.2	40.3	40.8	
Moderate	28.7	29.1	28.9	
Lower	30.1	30.5	30.3	
Presence of intimate partner violence (IPV) between mother and partner ^a				0.357
No IPV present	74.0	72.5	73.3	
IPV present	26.0	27.5	26.7	
Mother's number of adverse childhood experiences (ACEs) ^a				0.154
No ACEs present	27.2	24.8	25.9	
1 to 2 ACEs present	40.0	38.6	39.3	
3 or more ACEs present	32.8	36.6	34.7	
Mother's number of demographic risk factors				0.269
0 - 2 risk factors	62.0	63.7	62.8	
3 - 4 risk factors	38.0	36.3	37.2	
Parity				0.719
Mothers with prior children	40.6	40.0	40.3	
First-time mother	59.4	60.0	59.7	
Child's gestational age at enrollment				0.156
Up to 28 weeks pregnant	54.4	51.4	52.9	
More than 28 weeks pregnant	12.8	13.7	13.2	
After birth	32.7	34.9	33.8	
Mother's race and ethnicity ^a				0.012
Non-Hispanic, White	26.9	30.9	28.9	
Non-Hispanic, Black	33.0	29.5	31.3	
Hispanic	40.1	39.5	39.8	
Sample size (total = 4,102)	2,041	2,061		

SOURCES: Calculations based on the MIHOPE family baseline survey, state birth records, Medicaid enrollment data, and kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of how the subgroup categories are defined.

Distributions may not add to 100 percent because of rounding.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Mother's number of adverse childhood experiences (ACEs) was collected after study entry from the MIHOPE kindergarten caregiver survey.

^aMore than 3 percent of the sample is missing from this subgroup analysis. The sample was coded as missing for the subgroup analysis by presence of intimate partner violence between mother and partner characteristic if the mother was not in a relationship at the time of study entry (28 percent). The sample was coded as missing for the subgroup analysis by the mother's number of adverse childhood experiences if the mother is missing any item on this measure on the kindergarten caregiver survey or if the respondent was not the biological mother (46 percent). The sample was coded as missing if the mother did not answer both race and ethnicity questions on the family baseline survey (10 percent).

Subgroups had at least 10 percent of the total sample (about 400 families). For example, 60 percent of the women in the sample were first-time mothers, while 40 percent were not first-time mothers. Because subgroup sample sizes are smaller than the full sample, the subgroup tests cannot reliably detect differences as small as those that can be detected with the larger sample in MIHOPE.

The final column of Appendix Table F.1 presents results of a statistical test showing whether there are significant differences between the program group and the control group in the distributions of families across the subgroup categories within each of the eight subgroups. For example, the first two rows of the table show the two subgroup categories defined by level of psychological resources at study entry (higher levels versus lower levels). The program and control group members have similar distributions across the two categories of the psychological resources subgroup ($p = 0.113$). The distribution of program and control groups is similar within all sets of subgroups except among those defined by the mother's race and ethnicity. The differences in the distributions of the racial and ethnic groups of mothers are small, however, varying by just a few percentage points from the full-sample averages. These differences are unlikely to affect the subgroup findings because they are small. In addition, it is also possible that one comparison out of eight could be statistically significant due to chance.

Mother's Level of Psychological Resources

Appendix Tables F.2 through F.9 present findings for the subgroup defined by mothers' level of psychological resources, a composite measure based on mothers' depressive symptoms and anxiety,⁵ mastery,⁶ and verbal abstract reasoning when they entered the study.⁷ The subgroup categories are defined as:

- Mothers with higher levels of psychological resources (above median) (52.5 percent)
- Mothers with lower levels of psychological resources (at or below median) (47.5 percent)

5. Depression severity ranges from 0 (not depressed) to 30 (most severely depressed) and is based on a 10-item version of the Center for Epidemiologic Studies–Depression Scale. See Radloff (1977). Anxiety was measured using the Generalized Anxiety Disorder 7-item scale. See Spitzer, Kroenke, Williams, and Löwe (2006).

6. Mastery measures the extent to which a person thinks life chances are under his or her control. See Pearlin and Schooler (1978).

7. The concept of “psychological resources” is taken from the Nurse–Family Partnership Memphis pilot test, which hypothesized that effects on maternal caregiving and childhood injuries would be greater among mothers with few psychological resources. See Kitzman et al. (1997). Maternal psychological resources reflect (1) mental health as measured by the Center for Epidemiologic Studies–Depression Scale and the Generalized Anxiety Disorder 7 Scale; (2) mastery as measured by the Pearlin Mastery Scale; and (3) verbal abstract reasoning as measured by the Wechsler Adult Intelligence Scale–III and the Spanish equivalent Escala de Inteligencia Wechsler para Adultos–Tercera Edición. Used by permission of NCS Pearson. See Wechsler (1997); Wechsler (2008). The analysis summed these standardized scores (each of which had a mean of 100 and a standard deviation of 10) and standardized the sum in a similar way. Sample members were then divided into subgroups with total scores either below the median or above it.

Appendix Table F.2. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Level of Psychological Resources

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	24.51	24.70	-0.20	23.26	22.77	0.49 *	0.037
Perceived social support	20.30	20.07	0.23	18.75	17.61	1.15 ***	0.062
Resource mobilization	15.77	16.01	-0.24	14.76	14.48	0.28	0.180
Parenting distress							
Parenting distress	8.49	8.37	0.11	9.36	9.51	-0.15	0.417
Parent-child relationship							
Parental warmth	5.99	6.13	-0.14	5.87	5.90	-0.02	0.497
Parent-child dysfunctional interaction	8.66	8.61	0.05	9.81	10.65	-0.84 ***	0.010
Aggression toward child							
Frequency of psychological aggression during the past year	6.39	7.06	-0.68 *	6.12	6.20	-0.08	0.259
Frequency of physical aggression during the past year (%)	2.46	2.80	-0.35	4.44	4.43	0.01	0.831
Behavior toward child during semi-structured task							
Parental sensitivity	4.82	4.79	0.03	4.49	4.43	0.06	0.766
Parental positive regard	4.50	4.49	0.01	4.33	4.20	0.13 **	0.157
Parental stimulation of cognitive development	4.54	4.54	0.01	4.18	4.14	0.03	0.750
Parental intrusiveness	1.76	1.81	-0.05	1.95	1.93	0.02	0.389
Parental detachment	1.07	1.10	-0.02	1.14	1.18	-0.04	0.688
Parental negative regard	1.17	1.18	-0.01	1.17	1.18	-0.02	0.878

(continued)

Appendix Table F.2 (continued)

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development							
Reads to child daily (%)	40.26	37.45	2.81	36.58	41.42	-4.84	0.070
Average amount of reading to child per day in a typical week (minutes)	21.49	22.05	-0.55	21.53	21.55	-0.03	0.677
Number of children's books in the home	58.77	55.48	3.28	43.47	39.92	3.55	0.955
Composite of in-home literacy activities	0.73	0.72	0.01	0.64	0.64	0.00	0.640
Composite of in-home learning activities	0.63	0.64	-0.01	0.60	0.57	0.03 *	0.086
Percentage of days absent from school	8.29	7.30	0.99	8.70	9.78	-1.09	0.093
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.3. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Level of Psychological Resources

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	24.51	24.70	-0.20	23.26	22.77	0.49 *	0.037
Perceived social support	20.30	20.07	0.23	18.75	17.61	1.15 ***	0.062
Resource mobilization	15.77	16.01	-0.24	14.76	14.48	0.28	0.180
Parenting distress							
Parenting distress	8.49	8.37	0.11	9.36	9.51	-0.15	0.417
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	17.96	15.51	2.46	29.24	31.78	-2.53	0.163
Maternal substance use (%)							
Used illicit drugs	7.18	7.83	-0.65	6.84	8.36	-1.52	0.705
Excessive drinking	18.20	21.14	-2.94	18.81	13.82	4.99 **	0.016
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.4. Estimated Effects on Parent-Child Interactions
at Kindergarten, by Level of Psychological Resources**

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	5.99	6.13	-0.14	5.87	5.90	-0.02	0.497
Parent-child dysfunctional interaction	8.66	8.61	0.05	9.81	10.65	-0.84 ***	0.010
Aggression toward child							
Frequency of psychological aggression during the past year	6.39	7.06	-0.68 *	6.12	6.20	-0.08	0.259
Frequency of physical aggression during the past year (%)	2.46	2.80	-0.35	4.44	4.43	0.01	0.831
Behavior toward child during semi-structured task							
Parental sensitivity	4.82	4.79	0.03	4.49	4.43	0.06	0.766
Parental positive regard	4.50	4.49	0.01	4.33	4.20	0.13 **	0.157
Parental stimulation of cognitive development	4.54	4.54	0.01	4.18	4.14	0.03	0.750
Parental intrusiveness	1.76	1.81	-0.05	1.95	1.93	0.02	0.389
Parental detachment	1.07	1.10	-0.02	1.14	1.18	-0.04	0.688
Parental negative regard	1.17	1.18	-0.01	1.17	1.18	-0.02	0.878
Behavior toward parent during semi-structured task							
Child engagement of parent	5.05	5.05	0.00	4.99	4.98	0.01	0.919
Child negativity toward parent	1.27	1.24	0.03	1.24	1.31	-0.07 *	0.090
Parental support for learning and development							
Reads to child daily (%)	40.26	37.45	2.81	36.58	41.42	-4.84	0.070
Average amount of reading to child per day in a typical week (minutes)	21.49	22.05	-0.55	21.53	21.55	-0.03	0.677
Number of children's books in the home	58.77	55.48	3.28	43.47	39.92	3.55	0.955
Composite of in-home literacy activities	0.73	0.72	0.01	0.64	0.64	0.00	0.640
Composite of in-home learning activities	0.63	0.64	-0.01	0.60	0.57	0.03 *	0.086
Percentage of days absent from school	8.29	7.30	0.99	8.70	9.78	-1.09	0.093
Sample size (total = 4,007)	1,070	1,033		921	983		

(continued)

Appendix Table F.4 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.5. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Level of Psychological Resources

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.53	1.53	0.00	1.64	1.71	-0.08 **	0.088
Intimate partner violence (%)							
Maternal experience with physical violence	3.01	3.35	-0.34	2.79	5.47	-2.68 **	0.161
Maternal perpetration of physical violence	7.02	7.47	-0.46	8.85	7.39	1.46	0.412
Maternal experience with battering	1.91	2.34	-0.43	2.70	5.21	-2.52 **	0.165
Aggression toward child							
Frequency of psychological aggression during the past year	6.39	7.06	-0.68 *	6.12	6.20	-0.08	0.259
Frequency of physical aggression during the past year (%)	2.46	2.80	-0.35	4.44	4.43	0.01	0.831
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.82	1.02	-0.20	0.35	0.47	-0.12	0.907
Any substantiated report of neglect since 15 months	2.26	1.99	0.27	2.73	2.56	0.17	0.938
Any hospitalizations for injuries or ingestions since 15 months	2.93	2.10	0.83	1.94	2.00	-0.06	0.468
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.6. Estimated Effects on Economic Circumstances
at Kindergarten, by Level of Psychological Resources**

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	31.64	31.92	-0.28	26.88	29.84	-2.96	0.469
Receipt of high school diploma since study entry (%)	57.22	53.85	3.37	44.95	43.65	1.30	0.791
Quarters employed in past year	2.64	2.51	0.12	2.34	2.26	0.08	0.701
Average quarterly earnings in the past year (\$)	4,148.16	3,891.45	256.71	3,096.88	2,958.63	138.25	0.677
Household income in the past year (\$)	35,454.47	36,027.96	-573.49	26,513.06	26,768.95	-255.89	0.907
Material hardship							
Food insecurity (%)	17.81	20.51	-2.70	22.37	27.60	-5.23 *	0.530
Number of material hardships in the past year	1.25	1.36	-0.11	1.41	1.54	-0.13	0.881
Number of moves in past year	0.45	0.42	0.03	0.43	0.45	-0.02	0.557
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.7. Estimated Effects on Children's Social-Emotional Functioning
in the Home Context at Kindergarten, by Level of Psychological Resources**

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.70	17.65	0.05	17.29	17.10	0.19	0.641
Behavior problems							
Externalizing behaviors	9.35	9.60	-0.25	10.63	10.71	-0.08	0.730
Internalizing behaviors	4.64	4.95	-0.31	5.50	5.73	-0.23	0.827
Emotional and behavioral self-regulation							
Emotional self-control	13.82	13.65	0.17	12.91	12.58	0.33	0.665
Hyperactivity/inattention	7.41	7.61	-0.20	8.50	8.66	-0.16	0.920
Attention/impulse control	2.59	2.58	0.02	2.57	2.52	0.05	0.435
Behavior toward parent during semi-structured task							
Child engagement of parent	5.05	5.05	0.00	4.99	4.98	0.01	0.919
Child negativity toward parent	1.27	1.24	0.03	1.24	1.31	-0.07 *	0.090
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.8. Estimated Effects on Children's Social-Emotional Functioning
in School Settings at Kindergarten, by Level of Psychological Resources**

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	16.15	16.20	-0.05	15.54	14.87	0.67 *	0.176
Cooperation	12.69	12.97	-0.28	12.33	11.75	0.58	0.106
Assertive social skills	3.42	3.47	-0.05	3.25	3.07	0.17	0.141
Behavior problems							
Externalizing behaviors	7.93	7.52	0.40	8.17	9.13	-0.96	0.138
Internalizing behaviors	3.51	3.80	-0.29	4.02	4.35	-0.33	0.924
Emotional and behavioral self-regulation							
Emotional self-control	14.70	14.76	-0.06	14.33	13.39	0.94 *	0.144
Hyperactivity/inattention	7.18	6.77	0.40	7.32	8.28	-0.96 **	0.030
Task orientation	3.38	3.42	-0.04	3.23	3.04	0.19 *	0.097
Frustration tolerance	3.58	3.60	-0.02	3.50	3.31	0.19 *	0.144
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.9. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Level of Psychological Resources

Outcome	Higher Level of Psychological Resources			Lower Level of Psychological Resources			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.92	0.94	-0.01	0.94	0.94	-0.01	0.595
Cognitive flexibility - percent correct on valid trials	0.83	0.83	0.00	0.80	0.78	0.02	0.347
Short-term memory	3.92	3.99	-0.07	3.94	3.81	0.13 **	0.011
Language development							
Vocabulary knowledge	464.02	464.60	-0.58	461.18	461.31	-0.13	0.730
Mathematics development							
Early numeracy and math skills	428.46	429.45	-0.99	425.20	421.25	3.95 **	0.029
Sample size (total = 4,007)	1,070	1,033		921	983		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Of the 60 tests conducted for this subgroup, 13 outcomes (22 percent) showed a statistically significant difference in effects for groups of families split by the mother's level of psychological resources at study entry.⁸

Those 13 outcomes contribute to seven research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors (six differences out of 20 tests); (2) maternal mental health and behavioral health (three differences out of 7 tests); (3) parent-child interactions (five differences out of 18 tests); (4) family conflict, intimate partner violence, aggression, and child maltreatment (one difference out of 9 tests); (5) children's social-emotional functioning in the home context (one difference out of 8 tests); (6) children's social-emotional functioning in school settings (two differences out of 9 tests); and (7) children's cognitive, language, and early math skills (two differences out of 5 tests).⁹

In each of these research questions, when these differences were examined *within* subgroup category, the results suggest that the effects of home visiting may be more positive for mothers with lower levels of psychological resources as compared with mothers with higher levels of psychological resources at study entry.

Mother's Level of Emotional Functioning

Appendix Tables F.10 through F.17 present findings for the subgroup defined by mothers' level of emotional functioning, a composite measure that incorporates three constructs: the presence of depression, relationship anxiety, and relationship avoidance at the time mothers entered the study.¹⁰ The subgroup categories are defined as:

- Mothers with higher levels of emotional functioning (those who did not exhibit depressive symptoms, did not exhibit relationship anxiety, and did not exhibit relationship avoidance) (40.8 percent)
- Mothers with moderate levels of emotional functioning (those who exhibited one of these characteristics) (28.9 percent)
- Mothers with lower levels of emotional functioning (those who exhibited two or three of these characteristics) (30.3 percent)

-
8. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question.
 9. The research question related to economic circumstances did not have any significant differences in effects by mother's level of psychological resources.
 10. "Relationship anxiety" refers to an individual's excessive need for reassurance, fear of rejection, and a desire to merge with relationship partners. "Relationship avoidance" reflects the extent to which an individual avoids intimacy and is distrusting of others. See Mikulincer and Shaver (2007); McFarlane et al. (2010).

Appendix Table F.10. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.67	24.58	0.09	23.63	23.68	-0.05	23.00	22.72	0.28	0.777
Perceived social support	20.73	20.09	0.64 *	19.49	18.83	0.66	18.11	17.08	1.03 **	0.798
Resource mobilization	16.12	16.13	-0.01	15.06	15.11	-0.05	14.30	14.18	0.12	0.946
Parenting distress										
Parenting distress	8.04	8.13	-0.09	9.36	8.92	0.44	9.83	9.96	-0.13	0.327
Parent-child relationship										
Parental warmth	5.97	6.17	-0.20	5.96	5.89	0.07	5.92	5.87	0.05	0.283
Parent-child dysfunctional interaction	8.46	8.72	-0.26	9.69	9.68	0.01	9.67	10.91	-1.24 ***	0.030
Aggression toward child										
Frequency of psychological aggression during the past year	5.70	5.88	-0.18	6.11	6.71	-0.60	7.30	7.57	-0.26	0.815
Frequency of physical aggression during the past year (%)	2.58	2.49	0.10	3.11	3.13	-0.02	4.68	5.43	-0.76	0.926
Behavior toward child during semi-structured task										
Parental sensitivity	4.78	4.80	-0.02	4.70	4.52	0.18 **	4.47	4.44	0.03	0.214
Parental positive regard	4.47	4.42	0.05	4.41	4.41	0.00	4.34	4.21	0.13	0.551
Parental stimulation of cognitive development	4.50	4.53	-0.03	4.31	4.31	0.00	4.21	4.16	0.05	0.768
Parental intrusiveness	1.81	1.80	0.01	1.79	1.82	-0.03	1.97	1.99	-0.02	0.900
Parental detachment	1.06	1.12	-0.06 **	1.10	1.10	0.00	1.19	1.19	0.00	0.340
Parental negative regard	1.13	1.13	-0.01	1.18	1.17	0.01	1.21	1.27	-0.07	0.514

(continued)

Appendix Table F.10 (continued)

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	42.10	38.85	3.25	39.62	37.72	1.90	33.24	40.62	-7.38 *	0.105
Average amount of reading to child per day in a typical week (minutes)	21.10	22.29	-1.18	22.27	20.90	1.37	21.37	22.12	-0.75	0.231
Number of children's books in the home	56.34	55.04	1.30	46.47	48.99	-2.53	48.91	37.08	11.82 ***	0.029
Composite of in-home literacy activities	0.72	0.70	0.02	0.68	0.71	-0.02	0.64	0.63	0.01	0.530
Composite of in-home learning activities	0.63	0.61	0.02	0.62	0.61	0.01	0.59	0.58	0.00	0.902
Percentage of days absent from school	8.82	6.83	1.98 **	8.52	9.08	-0.56	8.28	9.78	-1.50	0.041
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.11. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.67	24.58	0.09	23.63	23.68	-0.05	23.00	22.72	0.28	0.777
Perceived social support	20.73	20.09	0.64 *	19.49	18.83	0.66	18.11	17.08	1.03 **	0.798
Resource mobilization	16.12	16.13	-0.01	15.06	15.11	-0.05	14.30	14.18	0.12	0.946
Parenting distress										
Parenting distress	8.04	8.13	-0.09	9.36	8.92	0.44	9.83	9.96	-0.13	0.327
Maternal depressive symptoms (%)										
Exhibits depressive symptoms	11.44	13.02	-1.58	22.29	20.89	1.40	40.16	41.50	-1.33	0.760
Maternal substance use (%)										
Used illicit drugs	5.83	5.66	0.17	6.38	10.20	-3.81 *	8.75	10.64	-1.89	0.342
Excessive drinking	16.23	17.95	-1.72	18.31	17.66	0.65	21.53	17.09	4.44	0.328
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.12. Estimated Effects on Parent-Child Interactions at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship										
Parental warmth	5.97	6.17	-0.20	5.96	5.89	0.07	5.92	5.87	0.05	0.283
Parent-child dysfunctional interaction	8.46	8.72	-0.26	9.69	9.68	0.01	9.67	10.91	-1.24 ***	0.030
Aggression toward child										
Frequency of psychological aggression during the past year	5.70	5.88	-0.18	6.11	6.71	-0.60	7.30	7.57	-0.26	0.815
Frequency of physical aggression during the past year (%)	2.58	2.49	0.10	3.11	3.13	-0.02	4.68	5.43	-0.76	0.926
Behavior toward child during semi-structured task										
Parental sensitivity	4.78	4.80	-0.02	4.70	4.52	0.18 **	4.47	4.44	0.03	0.214
Parental positive regard	4.47	4.42	0.05	4.41	4.41	0.00	4.34	4.21	0.13	0.551
Parental stimulation of cognitive development	4.50	4.53	-0.03	4.31	4.31	0.00	4.21	4.16	0.05	0.768
Parental intrusiveness	1.81	1.80	0.01	1.79	1.82	-0.03	1.97	1.99	-0.02	0.900
Parental detachment	1.06	1.12	-0.06 **	1.10	1.10	0.00	1.19	1.19	0.00	0.340
Parental negative regard	1.13	1.13	-0.01	1.18	1.17	0.01	1.21	1.27	-0.07	0.514
Behavior toward parent during semi-structured task										
Child engagement of parent	5.05	5.04	0.01	5.07	5.05	0.02	4.91	4.96	-0.05	0.842
Child negativity toward parent	1.25	1.23	0.02	1.25	1.22	0.03	1.26	1.40	-0.14 **	0.086

(continued)

Appendix Table F.12 (continued)

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	42.10	38.85	3.25	39.62	37.72	1.90	33.24	40.62	-7.38 *	0.105
Average amount of reading to child per day in a typical week (minutes)	21.10	22.29	-1.18	22.27	20.90	1.37	21.37	22.12	-0.75	0.231
Number of children's books in the home	56.34	55.04	1.30	46.47	48.99	-2.53	48.91	37.08	11.82 ***	0.029
Composite of in-home literacy activities	0.72	0.70	0.02	0.68	0.71	-0.02	0.64	0.63	0.01	0.530
Composite of in-home learning activities	0.63	0.61	0.02	0.62	0.61	0.01	0.59	0.58	0.00	0.902
Percentage of days absent from school	8.82	6.83	1.98 **	8.52	9.08	-0.56	8.28	9.78	-1.50	0.041
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.13. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict										
Family conflict	1.50	1.51	-0.01	1.60	1.62	-0.02	1.68	1.76	-0.08 *	0.458
Intimate partner violence (%)										
Maternal experience with physical violence	2.83	3.86	-1.03	3.00	2.83	0.17	3.54	6.09	-2.55	0.507
Maternal perpetration of physical violence	6.19	6.15	0.04	9.03	6.38	2.65	10.19	9.29	0.89	0.646
Maternal experience with battering	2.31	2.77	-0.46	2.25	2.06	0.19	3.08	5.70	-2.62	0.395
Aggression toward child										
Frequency of psychological aggression during the past year	5.70	5.88	-0.18	6.11	6.71	-0.60	7.30	7.57	-0.26	0.815
Frequency of physical aggression during the past year (%)	2.58	2.49	0.10	3.11	3.13	-0.02	4.68	5.43	-0.76	0.926
Child maltreatment (%)										
Any substantiated report of abuse since 15 months	0.30	0.47	-0.16	0.72	1.21	-0.48	0.84	0.69	0.15	0.812
Any substantiated report of neglect since 15 months	2.02	1.85	0.17	2.60	2.48	0.11	2.97	2.67	0.31	0.992
Any hospitalizations for injuries or ingestions since 15 months	2.63	2.53	0.10	3.81	1.36	2.45 *	1.11	1.80	-0.69	0.168
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.14. Estimated Effects on Economic Circumstances at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income										
Increase in education level since study entry (%)	28.85	29.06	-0.21	30.57	32.52	-1.96	30.26	29.59	0.67	0.866
Receipt of high school diploma since study entry (%)	44.62	46.30	-1.68	60.76	40.60	20.16 ***	49.30	51.33	-2.02	0.035
Quarters employed in past year	2.58	2.40	0.18 *	2.52	2.47	0.05	2.45	2.26	0.19 *	0.594
Average quarterly earnings in the past year (\$)	4,114.32	3,920.06	194.26	3,694.74	3,432.29	262.44	3,180.78	2,784.52	396.26 *	0.823
Household income in the past year (\$)	36,624.66	36,806.93	-182.27	28,405.58	29,475.69	-1,070.11	26,252.92	26,213.21	39.71	0.938
Material hardship										
Food insecurity (%)	16.76	17.66	-0.90	18.83	22.48	-3.65	26.29	34.02	-7.73 *	0.430
Number of material hardships in the past year	1.11	1.19	-0.08	1.33	1.46	-0.12	1.61	1.80	-0.20	0.763
Number of moves in past year	0.39	0.35	0.04	0.48	0.48	-0.01	0.49	0.51	-0.02	0.813
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.15. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	17.67	17.78	-0.11	17.76	17.23	0.53 *	16.99	17.04	-0.05	0.208
Behavior problems										
Externalizing behaviors	9.05	9.49	-0.45	9.67	9.53	0.14	11.53	11.50	0.03	0.546
Internalizing behaviors	4.43	4.69	-0.26	4.96	4.94	0.02	6.05	6.53	-0.47	0.598
Emotional and behavioral self-regulation										
Emotional self-control	14.23	13.74	0.48 *	13.66	13.16	0.50	12.01	12.23	-0.22	0.255
Hyperactivity/inattention	7.20	7.48	-0.28	7.75	7.79	-0.04	9.09	9.22	-0.13	0.840
Attention/impulse control	2.62	2.57	0.05	2.57	2.56	0.01	2.54	2.50	0.05	0.765
Behavior toward parent during semi-structured task										
Child engagement of parent	5.05	5.04	0.01	5.07	5.05	0.02	4.91	4.96	-0.05	0.842
Child negativity toward parent	1.25	1.23	0.02	1.25	1.22	0.03	1.26	1.40	-0.14 **	0.086
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.16. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	15.90	16.15	-0.25	16.12	15.34	0.78	15.47	14.96	0.51	0.271
Cooperation	12.59	12.87	-0.28	12.74	12.71	0.04	12.07	11.55	0.52	0.468
Assertive social skills	3.34	3.43	-0.09	3.29	3.32	-0.03	3.27	3.10	0.17	0.392
Behavior problems										
Externalizing behaviors	8.12	7.56	0.56	7.05	8.12	-1.07	9.07	9.12	-0.05	0.393
Internalizing behaviors	3.70	3.53	0.17	3.46	4.37	-0.91 *	4.16	4.54	-0.38	0.159
Emotional and behavioral self-regulation										
Emotional self-control	14.48	14.96	-0.48	15.00	13.94	1.06	13.79	13.35	0.45	0.213
Hyperactivity/inattention	7.20	7.08	0.11	6.75	7.05	-0.29	7.83	8.37	-0.54	0.690
Task orientation	3.33	3.38	-0.04	3.31	3.32	-0.02	3.24	3.01	0.23 *	0.263
Frustration tolerance	3.60	3.60	0.00	3.58	3.46	0.12	3.35	3.34	0.00	0.809
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.17. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Level of Emotional Functioning

Outcome	Higher Level of Emotional Functioning			Moderate Level of Emotional Functioning			Lower Level of Emotional Functioning			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills										
Inhibitory control - percent correct on valid trials	0.92	0.94	-0.02	0.94	0.94	0.00	0.92	0.94	-0.02	0.618
Cognitive flexibility - percent correct on valid trials	0.84	0.81	0.03 **	0.81	0.81	0.00	0.80	0.79	0.02	0.470
Short-term memory	3.89	3.90	-0.01	3.92	3.95	-0.03	4.01	3.84	0.17 **	0.106
Language development										
Vocabulary knowledge	462.68	462.99	-0.31	462.64	463.66	-1.01	462.64	462.58	0.06	0.806
Mathematics development										
Early numeracy and math skills	427.67	427.70	-0.02	425.99	425.83	0.16	425.96	423.38	2.58	0.593
Sample size (total = 4,044)	829	820		577	592		605	621		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Of the 60 tests conducted for this subgroup, five outcomes (8 percent) showed a statistically significant difference in effects for groups of families when split by the mother's level of emotional functioning at study entry.¹¹ However, due to the small number of statistically significant differences overall, the results by individual research question did not warrant interpretation. The tests for those five outcomes could show statistical significance based on sampling error alone.

Presence of Intimate Partner Violence Between Mother and Partner

Appendix Tables F.18 through F.25 present findings for the subgroup defined by the presence of IPV in the home at study entry. The subgroup categories are defined as:

- Mothers who indicated that IPV was not present (73.3 percent)
- Mothers who indicated that IPV was present (26.7 percent)

Of the 60 tests conducted for this subgroup, 10 outcomes (17 percent) showed a statistically significant difference in effects for groups of families split by whether there was a presence of intimate partner violence at study entry.

Those 10 outcomes contribute to five research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors (four differences out of 20 tests); (2) parent-child interactions (four differences out of 18 tests); (3) family conflict, intimate partner violence, aggression, and child maltreatment (one difference out of nine tests); (4) children's social-emotional functioning in the home context (three differences out of eight tests); (5) children's cognitive, language, and early math skills (two differences out of five tests).¹²

For these research questions, when these differences were examined *within* subgroup category, the results indicate that the differences in effects are mixed. The differences in effects do not suggest that effects are systematically more or less favorable for either category of families.

11. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question. The five outcomes that had significant differences in effects by mother's level of emotional functioning contribute to four research questions: (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors; (2) parent-child interactions; (3) economic circumstances; and (4) children's social-emotional functioning in the home context. Additionally, four research questions did not have any significant differences in effects by mother's level of emotional functioning: (1) maternal mental and behavioral health; (2) family conflict, intimate partner violence, aggression, and child maltreatment; (3) children's social-emotional functioning in school settings; and (4) children's cognitive, language, and early math skills.

12. Additionally, three research questions did not have any significant differences in effects by the presence of intimate partner violence: (1) maternal mental and behavioral health; (2) economic circumstances; and (3) children's social-emotional functioning in school settings.

Appendix Table F.18. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	24.00	24.07	-0.07	23.68	23.32	0.36	0.370
Perceived social support	19.95	19.49	0.46	18.82	18.35	0.47	0.995
Resource mobilization	15.59	15.55	0.04	14.64	14.72	-0.07	0.843
Parenting distress							
Parenting distress	8.42	8.37	0.05	9.90	9.82	0.08	0.958
Parent-child relationship							
Parental warmth	6.05	6.07	-0.01	5.86	6.01	-0.15	0.532
Parent-child dysfunctional interaction	8.89	9.09	-0.19	9.38	10.53	-1.15 ***	0.039
Aggression toward child							
Frequency of psychological aggression during the past year	5.33	5.82	-0.48	8.25	9.57	-1.32 *	0.327
Frequency of physical aggression during the past year (%)	2.13	3.59	-1.46	4.53	3.65	0.89	0.335
Behavior toward child during semi-structured task							
Parental sensitivity	4.75	4.68	0.07	4.66	4.65	0.01	0.637
Parental positive regard	4.46	4.38	0.08	4.52	4.44	0.08	0.990
Parental stimulation of cognitive development	4.43	4.38	0.05	4.31	4.51	-0.21 *	0.046
Parental intrusiveness	1.79	1.82	-0.03	1.88	1.91	-0.03	0.974
Parental detachment	1.06	1.13	-0.06 ***	1.21	1.09	0.13 **	0.004
Parental negative regard	1.12	1.16	-0.05 *	1.23	1.22	0.01	0.469

(continued)

Appendix Table F.18 (continued)

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development							
Reads to child daily (%)	42.98	40.24	2.74	27.44	37.51	-10.06 **	0.025
Average amount of reading to child per day in a typical week (minutes)	21.71	22.10	-0.39	19.30	21.22	-1.92	0.403
Number of children's books in the home	51.34	50.02	1.32	55.66	48.27	7.39	0.413
Composite of in-home literacy activities	0.71	0.70	0.00	0.64	0.64	0.00	0.896
Composite of in-home learning activities	0.63	0.60	0.02	0.60	0.59	0.01	0.651
Percentage of days absent from school	8.24	7.41	0.83	9.52	8.30	1.22	0.851
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.19. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	24.00	24.07	-0.07	23.68	23.32	0.36	0.370
Perceived social support	19.95	19.49	0.46	18.82	18.35	0.47	0.995
Resource mobilization	15.59	15.55	0.04	14.64	14.72	-0.07	0.843
Parenting distress							
Parenting distress	8.42	8.37	0.05	9.90	9.82	0.08	0.958
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	17.39	18.59	-1.19	31.58	28.83	2.75	0.456
Maternal substance use (%)							
Used illicit drugs	5.78	7.15	-1.37	7.97	12.34	-4.38	0.398
Excessive drinking	16.08	16.61	-0.53	23.58	21.71	1.87	0.630
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.20. Estimated Effects on Parent-Child Interactions
at Kindergarten, by Presence of Intimate Partner Violence**

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	6.05	6.07	-0.01	5.86	6.01	-0.15	0.532
Parent-child dysfunctional interaction	8.89	9.09	-0.19	9.38	10.53	-1.15 ***	0.039
Aggression toward child							
Frequency of psychological aggression during the past year	5.33	5.82	-0.48	8.25	9.57	-1.32 *	0.327
Frequency of physical aggression during the past year (%)	2.13	3.59	-1.46	4.53	3.65	0.89	0.335
Behavior toward child during semi-structured task							
Parental sensitivity	4.75	4.68	0.07	4.66	4.65	0.01	0.637
Parental positive regard	4.46	4.38	0.08	4.52	4.44	0.08	0.990
Parental stimulation of cognitive development	4.43	4.38	0.05	4.31	4.51	-0.21 *	0.046
Parental intrusiveness	1.79	1.82	-0.03	1.88	1.91	-0.03	0.974
Parental detachment	1.06	1.13	-0.06 ***	1.21	1.09	0.13 **	0.004
Parental negative regard	1.12	1.16	-0.05 *	1.23	1.22	0.01	0.469
Behavior toward parent during semi-structured task							
Child engagement of parent	5.09	5.04	0.04	4.96	5.05	-0.09	0.312
Child negativity toward parent	1.23	1.26	-0.03	1.29	1.27	0.02	0.534
Parental support for learning and development							
Reads to child daily (%)	42.98	40.24	2.74	27.44	37.51	-10.06 **	0.025
Average amount of reading to child per day in a typical week (minutes)	21.71	22.10	-0.39	19.30	21.22	-1.92	0.403
Number of children's books in the home	51.34	50.02	1.32	55.66	48.27	7.39	0.413
Composite of in-home literacy activities	0.71	0.70	0.00	0.64	0.64	0.00	0.896
Composite of in-home learning activities	0.63	0.60	0.02	0.60	0.59	0.01	0.651
Percentage of days absent from school	8.24	7.41	0.83	9.52	8.30	1.22	0.851
Sample size (total = 2,935)	1,093	1,057		384	401		

(continued)

Appendix Table F.20 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.21. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.52	1.57	-0.04	1.67	1.70	-0.03	0.857
Intimate partner violence (%)							
Maternal experience with physical violence	2.05	2.84	-0.78	5.03	9.04	-4.01	0.269
Maternal perpetration of physical violence	3.88	4.61	-0.73	17.22	18.83	-1.61	0.835
Maternal experience with battering	2.03	4.01	-1.99 **	3.82	4.26	-0.44	0.515
Aggression toward child							
Frequency of psychological aggression during the past year	5.33	5.82	-0.48	8.25	9.57	-1.32 *	0.327
Frequency of physical aggression during the past year (%)	2.13	3.59	-1.46	4.53	3.65	0.89	0.335
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.62	0.53	0.09	1.58	0.76	0.82	0.544
Any substantiated report of neglect since 15 months	2.35	2.43	-0.08	3.28	1.84	1.45	0.397
Any hospitalizations for injuries or ingestions since 15 months	1.81	1.93	-0.12	3.19	0.73	2.46 *	0.091
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.22. Estimated Effects on Economic Circumstances
at Kindergarten, by Presence of Intimate Partner Violence**

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	27.22	29.30	-2.08	28.64	35.29	-6.65	0.400
Receipt of high school diploma since study entry (%)	46.41	45.91	0.49	41.41	57.70	-16.30	0.217
Quarters employed in past year	2.48	2.39	0.09	2.49	2.31	0.18	0.588
Average quarterly earnings in the past year (\$)	3,917.32	3,728.30	189.02	3,510.14	2,959.66	550.48 *	0.331
Household income in the past year (\$)	35,777.12	35,469.36	307.76	26,611.96	29,977.34	-3,365.38	0.355
Material hardship							
Food insecurity (%)	17.36	20.66	-3.31	28.10	37.32	-9.22	0.336
Number of material hardships in the past year	1.16	1.26	-0.10	1.66	1.97	-0.32 *	0.231
Number of moves in past year	0.42	0.38	0.04	0.51	0.53	-0.02	0.645
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.23. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.52	17.58	-0.06	17.22	17.06	0.16	0.617
Behavior problems							
Externalizing behaviors	9.53	9.57	-0.03	10.44	11.84	-1.41 **	0.052
Internalizing behaviors	4.76	4.84	-0.08	5.39	6.59	-1.20 ***	0.025
Emotional and behavioral self-regulation							
Emotional self-control	13.72	13.65	0.07	12.67	12.41	0.26	0.710
Hyperactivity/inattention	7.64	7.79	-0.15	7.98	9.21	-1.22 ***	0.032
Attention/impulse control	2.61	2.57	0.04	2.52	2.57	-0.06	0.117
Behavior toward parent during semi-structured task							
Child engagement of parent	5.09	5.04	0.04	4.96	5.05	-0.09	0.312
Child negativity toward parent	1.23	1.26	-0.03	1.29	1.27	0.02	0.534
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.24. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	15.88	15.67	0.21	15.55	15.56	-0.01	0.795
Cooperation	12.75	12.66	0.08	12.67	12.34	0.33	0.768
Assertive social skills	3.37	3.27	0.10	3.26	3.34	-0.08	0.440
Behavior problems							
Externalizing behaviors	7.71	7.86	-0.16	7.37	8.79	-1.42	0.417
Internalizing behaviors	3.71	3.91	-0.21	4.07	4.22	-0.15	0.935
Emotional and behavioral self-regulation							
Emotional self-control	14.85	14.48	0.37	15.05	13.65	1.41	0.378
Hyperactivity/inattention	7.03	7.26	-0.23	6.55	8.06	-1.51	0.221
Task orientation	3.35	3.25	0.10	3.35	3.27	0.08	0.923
Frustration tolerance	3.61	3.51	0.10	3.59	3.31	0.29	0.411
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.25. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Presence of Intimate Partner Violence

Outcome	No IPV at Study Entry			IPV at Study Entry			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.94	-0.01	0.90	0.96	-0.06 ***	0.038
Cognitive flexibility - percent correct on valid trials	0.83	0.82	0.01	0.79	0.82	-0.04	0.093
Short-term memory	3.90	3.89	0.02	3.98	3.97	0.00	0.896
Language development							
Vocabulary knowledge	462.37	462.35	0.02	462.79	465.25	-2.46 *	0.151
Mathematics development							
Early numeracy and math skills	427.51	427.06	0.45	424.37	426.57	-2.19	0.365
Sample size (total = 2,935)	1,093	1,057		384	401		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

IPV = intimate partner violence.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Mother's Number of Adverse Childhood Experiences

Appendix Tables F.26 through F.33 present findings for the subgroup defined by the mothers' number of adverse childhood experiences. Using what mothers reported on retrospectively on the kindergarten caregiver survey, the subgroup categories are defined as:

- Mothers who experienced zero ACEs (25.9 percent)
- Mothers who experienced one or two ACEs (39.3 percent)
- Mothers who experienced three or more ACEs (34.7 percent)

Of the 60 tests conducted for this subgroup, six outcomes (10 percent) showed a statistically significant difference in effects for groups of families split by the number of ACEs the mother reported.¹³ However, due to the small number of statistically significant differences overall, the results by individual research question did not warrant interpretation. The tests for those six outcomes could show statistical significance based on sampling error alone.

Mother's Number of Demographic Risk Factors

Appendix Tables F.34 through F.41 present findings for the subgroup defined by demographic risk for each of the research questions. The subgroup categories include factors that have been identified in prior literature as being associated with higher risk of negative outcomes for mothers or their children: whether mothers received public assistance or were enrolled in Medicaid, whether they were 20 years old or younger, whether the child's biological father did not live in the home, and whether the mother was not enrolled in school (if younger than age 19) or had not received a high school degree (if at least 19 years old). The subgroup categories are defined as:

- Mothers in the lower-risk subgroup had zero to two of these risk factors (62.8 percent)
- Mothers in the higher-risk subgroup had three or four of the risk factors (37.2 percent)¹⁴

13. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question. The six outcomes that had statistically significant differences in effects by mother's number of adverse childhood experiences contribute to four research questions: (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors; (2) parent-child interactions; (3) economic circumstances; and (4) children's social-emotional functioning in school settings. Additionally, four research questions did not have any significant differences in effects by mother's number of adverse childhood experiences: (1) maternal mental and behavioral health; (2) family conflict, intimate partner violence, aggression, and child maltreatment; (3) children's social-emotional functioning in the home context; and (4) children's cognitive, language, and early math skills.

14. For the kindergarten subgroup analysis, the study team combined the moderate (3 factors) and higher (4 factors) risk categories used in the 15-month analysis because the higher risk category included less than 10 percent of the kindergarten sample.

Appendix Table F.26. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	24.07	-0.04	24.05	24.05	0.00	23.71	23.40	0.31	0.664
Perceived social support	20.04	19.21	0.83	19.87	19.08	0.80 **	18.72	18.68	0.04	0.370
Resource mobilization	15.57	15.72	-0.15	15.31	15.37	-0.06	14.93	15.19	-0.26	0.917
Parenting distress										
Parenting distress	8.37	8.39	-0.02	8.74	8.61	0.13	9.46	9.52	-0.05	0.883
Parent-child relationship										
Parental warmth	5.76	5.87	-0.11	5.96	5.88	0.08	6.24	6.23	0.01	0.709
Parent-child dysfunctional interaction	8.84	9.48	-0.64 *	9.20	9.20	0.00	9.56	9.89	-0.34	0.335
Aggression toward child										
Frequency of psychological aggression during the past year	4.13	4.22	-0.09	5.69	6.05	-0.36	8.08	8.91	-0.83	0.562
Frequency of physical aggression during the past year (%)	1.48	3.54	-2.05	3.12	3.12	0.00	4.67	3.76	0.92	0.357
Behavior toward child during semi-structured task										
Parental sensitivity	4.54	4.58	-0.04	4.66	4.56	0.10	4.80	4.71	0.09	0.545
Parental positive regard	4.33	4.28	0.05	4.38	4.32	0.06	4.57	4.48	0.09	0.953
Parental stimulation of cognitive development	4.21	4.36	-0.15	4.35	4.30	0.05	4.52	4.45	0.07	0.179
Parental intrusiveness	1.98	1.80	0.18 **	1.78	1.87	-0.09	1.92	1.88	0.04	0.064
Parental detachment	1.12	1.17	-0.05	1.09	1.13	-0.04	1.08	1.13	-0.05	0.961
Parental negative regard	1.18	1.10	0.08 *	1.14	1.18	-0.04	1.23	1.23	0.01	0.125

(continued)

Appendix Table F.26 (continued)

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	50.37	39.74	10.63 **	35.73	39.20	-3.47	36.47	35.90	0.57	0.041
Average amount of reading to child per day in a typical week (minutes)	22.47	22.19	0.28	21.88	21.59	0.29	20.87	21.42	-0.54	0.825
Number of children's books in the home	45.20	43.48	1.72	47.09	42.64	4.45	61.17	55.93	5.24	0.854
Composite of in-home literacy activities	0.69	0.69	0.00	0.67	0.69	-0.03	0.70	0.67	0.03	0.249
Composite of in-home learning activities	0.63	0.62	0.00	0.60	0.61	-0.01	0.62	0.59	0.02	0.523
Percentage of days absent from school	5.96	7.51	-1.55	7.93	8.99	-1.06	9.76	9.06	0.71	0.671
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.27. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	24.07	-0.04	24.05	24.05	0.00	23.71	23.40	0.31	0.664
Perceived social support	20.04	19.21	0.83	19.87	19.08	0.80 **	18.72	18.68	0.04	0.370
Resource mobilization	15.57	15.72	-0.15	15.31	15.37	-0.06	14.93	15.19	-0.26	0.917
Parenting distress										
Parenting distress	8.37	8.39	-0.02	8.74	8.61	0.13	9.46	9.52	-0.05	0.883
Maternal depressive symptoms (%)										
Exhibits depressive symptoms	11.98	7.34	4.64 *	19.36	19.30	0.06	33.93	35.57	-1.63	0.297
Maternal substance use (%)										
Used illicit drugs	3.51	2.03	1.48	5.45	6.30	-0.85	12.20	13.03	-0.83	0.535
Excessive drinking	11.14	11.20	-0.07	19.09	16.72	2.37	24.47	21.37	3.10	0.735
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.28. Estimated Effects on Parent-Child Interactions at Kindergarten,
by Number of Adverse Childhood Experiences**

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship										
Parental warmth	5.76	5.87	-0.11	5.96	5.88	0.08	6.24	6.23	0.01	0.709
Parent-child dysfunctional interaction	8.84	9.48	-0.64 *	9.20	9.20	0.00	9.56	9.89	-0.34	0.335
Aggression toward child										
Frequency of psychological aggression during the past year	4.13	4.22	-0.09	5.69	6.05	-0.36	8.08	8.91	-0.83	0.562
Frequency of physical aggression during the past year (%)	1.48	3.54	-2.05	3.12	3.12	0.00	4.67	3.76	0.92	0.357
Behavior toward child during semi-structured task										
Parental sensitivity	4.54	4.58	-0.04	4.66	4.56	0.10	4.80	4.71	0.09	0.545
Parental positive regard	4.33	4.28	0.05	4.38	4.32	0.06	4.57	4.48	0.09	0.953
Parental stimulation of cognitive development	4.21	4.36	-0.15	4.35	4.30	0.05	4.52	4.45	0.07	0.179
Parental intrusiveness	1.98	1.80	0.18 **	1.78	1.87	-0.09	1.92	1.88	0.04	0.064
Parental detachment	1.12	1.17	-0.05	1.09	1.13	-0.04	1.08	1.13	-0.05	0.961
Parental negative regard	1.18	1.10	0.08 *	1.14	1.18	-0.04	1.23	1.23	0.01	0.125
Behavior toward parent during semi-structured task										
Child engagement of parent	5.00	5.03	-0.03	5.02	5.04	-0.01	5.08	4.97	0.11	0.444
Child negativity toward parent	1.28	1.19	0.09	1.24	1.23	0.00	1.28	1.33	-0.05	0.209

(continued)

Appendix Table F.28 (continued)

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	50.37	39.74	10.63 **	35.73	39.20	-3.47	36.47	35.90	0.57	0.041
Average amount of reading to child per day in a typical week (minutes)	22.47	22.19	0.28	21.88	21.59	0.29	20.87	21.42	-0.54	0.825
Number of children's books in the home	45.20	43.48	1.72	47.09	42.64	4.45	61.17	55.93	5.24	0.854
Composite of in-home literacy activities	0.69	0.69	0.00	0.67	0.69	-0.03	0.70	0.67	0.03	0.249
Composite of in-home learning activities	0.63	0.62	0.00	0.60	0.61	-0.01	0.62	0.59	0.02	0.523
Percentage of days absent from school	5.96	7.51	-1.55	7.93	8.99	-1.06	9.76	9.06	0.71	0.671
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.29. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict										
Family conflict	1.55	1.59	-0.04	1.54	1.58	-0.03	1.64	1.66	-0.02	0.966
Intimate partner violence (%)										
Maternal experience with physical violence	1.85	4.15	-2.30	2.52	4.86	-2.34 *	3.54	4.26	-0.71	0.690
Maternal perpetration of physical violence	6.36	6.20	0.16	8.42	8.67	-0.24	8.18	7.78	0.40	0.976
Maternal experience with battering	3.56	2.71	0.85	1.33	3.82	-2.50 **	2.77	4.45	-1.68	0.239
Aggression toward child										
Frequency of psychological aggression during the past year	4.13	4.22	-0.09	5.69	6.05	-0.36	8.08	8.91	-0.83	0.562
Frequency of physical aggression during the past year (%)	1.48	3.54	-2.05	3.12	3.12	0.00	4.67	3.76	0.92	0.357
Child maltreatment (%)										
Any substantiated report of abuse since 15 months	0.56	1.02	-0.46	0.36	-0.02	0.38	0.42	0.79	-0.38	0.511
Any substantiated report of neglect since 15 months	1.99	2.10	-0.11	1.25	1.91	-0.66	3.26	1.89	1.37	0.582
Any hospitalizations for injuries or ingestions since 15 months	3.28	1.82	1.46	1.46	2.26	-0.81	2.07	1.87	0.20	0.607
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.30. Estimated Effects on Economic Circumstances
at Kindergarten, by Number of Adverse Childhood Experiences**

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income										
Increase in education level since study entry (%)	29.28	29.31	-0.03	27.80	29.75	-1.95	30.58	33.85	-3.27	0.821
Receipt of high school diploma since study entry (%)	52.23	44.23	8.00	47.39	50.25	-2.86	46.22	50.59	-4.37	0.524
Quarters employed in past year	2.46	2.43	0.03	2.50	2.50	0.00	2.68	2.26	0.43 ***	0.063
Average quarterly earnings in the past year (\$)	3,717.32	3,498.33	219.00	3,595.43	3,600.01	-4.57	4,103.31	3,413.33	689.98 *	0.345
Household income in the past year (\$)	31,214.90	31,346.82	-131.92	30,602.48	32,361.78	-1,759.30	33,695.59	30,573.91	3,121.68	0.370
Material hardship										
Food insecurity (%)	12.63	13.03	-0.40	16.08	20.91	-4.83	30.49	32.94	-2.45	0.634
Number of material hardships in the past year	0.91	0.98	-0.08	1.21	1.34	-0.13	1.70	1.85	-0.15	0.919
Number of moves in past year	0.43	0.29	0.14 **	0.39	0.43	-0.05	0.53	0.53	0.00	0.115
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.31. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	18.00	17.56	0.44	17.63	17.49	0.15	17.04	17.18	-0.14	0.391
Behavior problems										
Externalizing behaviors	8.60	8.16	0.44	9.71	9.75	-0.04	10.81	11.74	-0.93 **	0.108
Internalizing behaviors	4.17	4.02	0.15	4.76	4.96	-0.19	5.83	6.46	-0.63 *	0.259
Emotional and behavioral self-regulation										
Emotional self-control	14.51	14.22	0.28	13.60	13.34	0.26	12.61	12.41	0.20	0.985
Hyperactivity/inattention	7.12	6.70	0.41	7.80	7.96	-0.16	8.49	8.94	-0.45	0.209
Attention/impulse control	2.58	2.59	-0.01	2.61	2.57	0.04	2.54	2.52	0.02	0.686
Behavior toward parent during semi-structured task										
Child engagement of parent	5.00	5.03	-0.03	5.02	5.04	-0.01	5.08	4.97	0.11	0.444
Child negativity toward parent	1.28	1.19	0.09	1.24	1.23	0.00	1.28	1.33	-0.05	0.209
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.32. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	15.41	16.08	-0.66	16.39	15.33	1.06 **	15.89	15.40	0.49	0.105
Cooperation	12.25	12.84	-0.59	12.98	11.91	1.07 **	12.56	12.39	0.17	0.124
Assertive social skills	3.17	3.16	0.02	3.43	3.21	0.22	3.42	3.34	0.08	0.660
Behavior problems										
Externalizing behaviors	8.33	6.98	1.36	7.35	8.92	-1.57 *	8.54	8.28	0.25	0.095
Internalizing behaviors	3.96	3.95	0.01	3.12	4.39	-1.27 ***	4.22	3.73	0.49	0.004
Emotional and behavioral self-regulation										
Emotional self-control	13.98	14.77	-0.79	15.11	13.81	1.30 **	14.61	13.83	0.78	0.110
Hyperactivity/inattention	7.53	6.53	1.00	6.51	7.93	-1.42 **	7.44	7.79	-0.35	0.034
Task orientation	3.21	3.23	-0.02	3.43	3.16	0.27 **	3.33	3.29	0.04	0.330
Frustration tolerance	3.46	3.55	-0.09	3.67	3.41	0.26 **	3.54	3.41	0.13	0.263
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.33. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Number of Adverse Childhood Experiences

Outcome	No ACEs			1 or 2 ACEs			3 or More ACEs			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills										
Inhibitory control - percent correct on valid trials	0.93	0.94	-0.01	0.93	0.94	-0.01	0.92	0.94	-0.01	0.958
Cognitive flexibility - percent correct on valid trials	0.80	0.80	0.00	0.80	0.80	0.01	0.84	0.81	0.03	0.607
Short-term memory	3.86	3.84	0.02	3.88	3.88	0.00	3.98	3.95	0.03	0.950
Language development										
Vocabulary knowledge	460.69	460.52	0.17	461.56	461.62	-0.06	463.69	466.63	-2.94 ***	0.117
Mathematics development										
Early numeracy and math skills	425.65	422.52	3.13	425.20	425.17	0.03	428.33	427.83	0.50	0.587
Sample size (total = 2,216)	297	278		437	434		359	411		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

ACEs = adverse childhood experiences.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.34. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.98	23.75	0.24	23.86	23.77	0.09	0.667
Perceived social support	19.82	19.05	0.77 **	19.00	18.71	0.29	0.379
Resource mobilization	15.57	15.28	0.29	14.71	15.36	-0.65 *	0.024
Parenting distress							
Parenting distress	8.81	8.86	-0.05	9.00	9.05	-0.05	0.991
Parent-child relationship							
Parental warmth	6.03	6.14	-0.11	5.76	5.75	0.01	0.487
Parent-child dysfunctional interaction	9.02	9.49	-0.47 **	9.57	9.68	-0.10	0.324
Aggression toward child							
Frequency of psychological aggression during the past year	6.37	7.14	-0.77 **	6.02	5.56	0.46	0.030
Frequency of physical aggression during the past year (%)	2.56	3.87	-1.30	4.58	2.86	1.72	0.087
Behavior toward child during semi-structured task							
Parental sensitivity	4.76	4.71	0.05	4.49	4.44	0.05	0.976
Parental positive regard	4.48	4.42	0.06	4.28	4.25	0.03	0.725
Parental stimulation of cognitive development	4.45	4.43	0.02	4.23	4.19	0.03	0.852
Parental intrusiveness	1.82	1.84	-0.01	1.93	1.89	0.04	0.599
Parental detachment	1.10	1.13	-0.03	1.12	1.14	-0.02	0.851
Parental negative regard	1.14	1.18	-0.04	1.21	1.19	0.02	0.284
Parental support for learning and development							
Reads to child daily (%)	41.74	38.78	2.96	35.24	38.34	-3.10	0.185
Average amount of reading to child per day in a typical week (minutes)	20.86	21.64	-0.78	22.38	22.53	-0.14	0.636
Number of children's books in the home	58.54	54.68	3.86	37.41	34.98	2.43	0.747
Composite of in-home literacy activities	0.70	0.69	0.01	0.66	0.67	-0.01	0.595
Composite of in-home learning activities	0.61	0.59	0.02	0.62	0.64	-0.02	0.143
Percentage of days absent from school	7.98	7.52	0.46	9.16	9.91	-0.75	0.333
Sample size (total = 4,090)	1,261	1,309		773	747		

(continued)

Appendix Table F.34 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.35. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.98	23.75	0.24	23.86	23.77	0.09	0.667
Perceived social support	19.82	19.05	0.77 **	19.00	18.71	0.29	0.379
Resource mobilization	15.57	15.28	0.29	14.71	15.36	-0.65 *	0.024
Parenting distress							
Parenting distress	8.81	8.86	-0.05	9.00	9.05	-0.05	0.991
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	20.51	23.10	-2.60	27.21	23.35	3.86	0.089
Maternal substance use (%)							
Used illicit drugs	7.73	8.19	-0.46	6.91	6.96	-0.05	0.866
Excessive drinking	16.31	18.52	-2.21	21.98	15.80	6.18 **	0.018
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.36. Estimated Effects on Parent-Child Interactions
at Kindergarten, by Number of Demographic Risk Factors**

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	6.03	6.14	-0.11	5.76	5.75	0.01	0.487
Parent-child dysfunctional interaction	9.02	9.49	-0.47 **	9.57	9.68	-0.10	0.324
Aggression toward child							
Frequency of psychological aggression during the past year	6.37	7.14	-0.77 **	6.02	5.56	0.46	0.030
Frequency of physical aggression during the past year (%)	2.56	3.87	-1.30	4.58	2.86	1.72	0.087
Behavior toward child during semi-structured task							
Parental sensitivity	4.76	4.71	0.05	4.49	4.44	0.05	0.976
Parental positive regard	4.48	4.42	0.06	4.28	4.25	0.03	0.725
Parental stimulation of cognitive development	4.45	4.43	0.02	4.23	4.19	0.03	0.852
Parental intrusiveness	1.82	1.84	-0.01	1.93	1.89	0.04	0.599
Parental detachment	1.10	1.13	-0.03	1.12	1.14	-0.02	0.851
Parental negative regard	1.14	1.18	-0.04	1.21	1.19	0.02	0.284
Behavior toward parent during semi-structured task							
Child engagement of parent	5.09	5.02	0.08	4.89	5.03	-0.14 *	0.023
Child negativity toward parent	1.26	1.27	-0.01	1.27	1.24	0.03	0.578
Parental support for learning and development							
Reads to child daily (%)	41.74	38.78	2.96	35.24	38.34	-3.10	0.185
Average amount of reading to child per day in a typical week (minutes)	20.86	21.64	-0.78	22.38	22.53	-0.14	0.636
Number of children's books in the home	58.54	54.68	3.86	37.41	34.98	2.43	0.747
Composite of in-home literacy activities	0.70	0.69	0.01	0.66	0.67	-0.01	0.595
Composite of in-home learning activities	0.61	0.59	0.02	0.62	0.64	-0.02	0.143
Percentage of days absent from school	7.98	7.52	0.46	9.16	9.91	-0.75	0.333
Sample size (total = 4,090)	1,261	1,309		773	747		

(continued)

Appendix Table F.36 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.37. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.58	1.61	-0.03	1.59	1.61	-0.01	0.657
Intimate partner violence (%)							
Maternal experience with physical violence	3.46	4.50	-1.04	2.57	3.27	-0.71	0.839
Maternal perpetration of physical violence	7.88	8.20	-0.32	7.74	5.41	2.33	0.269
Maternal experience with battering	2.51	4.55	-2.03 **	1.66	1.91	-0.25	0.205
Aggression toward child							
Frequency of psychological aggression during the past year	6.37	7.14	-0.77 **	6.02	5.56	0.46	0.030
Frequency of physical aggression during the past year (%)	2.56	3.87	-1.30	4.58	2.86	1.72	0.087
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.85	0.71	0.14	0.18	0.83	-0.64	0.228
Any substantiated report of neglect since 15 months	2.25	2.32	-0.08	3.17	1.93	1.24	0.315
Any hospitalizations for injuries or ingestions since 15 months	2.15	1.77	0.38	2.59	2.88	-0.29	0.613
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table F.38. Estimated Effects on Economic Circumstances
at Kindergarten, by Number of Demographic Risk Factors**

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	21.90	23.90	-2.00	43.74	43.66	0.07	0.611
Receipt of high school diploma since study entry (%)	41.39	40.17	1.22	54.60	51.55	3.05	0.814
Quarters employed in past year	2.51	2.42	0.10	2.53	2.32	0.21 **	0.330
Average quarterly earnings in the past year (\$)	4,064.89	3,865.22	199.67	3,099.90	2,730.48	369.42 *	0.541
Household income in the past year (\$)	35,048.55	34,914.76	133.79	24,660.19	24,715.25	-55.07	0.944
Material hardship							
Food insecurity (%)	19.88	24.15	-4.27 *	21.08	22.65	-1.57	0.526
Number of material hardships in the past year	1.26	1.42	-0.16 **	1.45	1.46	-0.02	0.319
Number of moves in past year	0.38	0.37	0.02	0.56	0.57	-0.01	0.758
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.39. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.40	17.42	-0.01	17.64	17.35	0.29	0.356
Behavior problems							
Externalizing behaviors	9.81	10.45	-0.64 **	10.16	9.49	0.67	0.016
Internalizing behaviors	4.96	5.39	-0.43 **	5.17	5.19	-0.02	0.277
Emotional and behavioral self-regulation							
Emotional self-control	13.57	13.23	0.34	12.93	13.17	-0.24	0.158
Hyperactivity/inattention	7.75	8.23	-0.48 **	8.12	7.85	0.27	0.053
Attention/impulse control	2.59	2.56	0.03	2.56	2.53	0.03	0.930
Behavior toward parent during semi-structured task							
Child engagement of parent	5.09	5.02	0.08	4.89	5.03	-0.14 *	0.023
Child negativity toward parent	1.26	1.27	-0.01	1.27	1.24	0.03	0.578
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.40. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	16.03	15.58	0.45	15.49	15.39	0.10	0.546
Cooperation	12.88	12.44	0.44	11.99	12.10	-0.11	0.327
Assertive social skills	3.40	3.31	0.09	3.24	3.14	0.10	0.974
Behavior problems							
Externalizing behaviors	7.45	8.24	-0.79	9.40	8.21	1.19	0.055
Internalizing behaviors	3.70	4.00	-0.31	4.00	4.23	-0.22	0.864
Emotional and behavioral self-regulation							
Emotional self-control	14.86	14.16	0.70 *	13.82	13.89	-0.07	0.306
Hyperactivity/inattention	6.88	7.51	-0.63 *	7.89	7.54	0.36	0.149
Task orientation	3.42	3.25	0.17 **	3.17	3.14	0.04	0.401
Frustration tolerance	3.62	3.47	0.15 *	3.38	3.45	-0.07	0.149
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups. Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.41. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Number of Demographic Risk Factors

Outcome	0 to 2 Risk Factors			3 or 4 Risk Factors			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.94	-0.01	0.93	0.95	-0.02	0.476
Cognitive flexibility - percent correct on valid trials	0.83	0.82	0.01	0.80	0.78	0.03	0.377
Short-term memory	3.94	3.91	0.03	3.91	3.86	0.05	0.838
Language development							
Vocabulary knowledge	463.15	463.41	-0.26	461.97	461.84	0.13	0.777
Mathematics development							
Early numeracy and math skills	428.15	427.42	0.73	424.15	422.24	1.91	0.613
Sample size (total = 4,090)	1,261	1,309		773	747		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Of the 60 tests conducted for this subgroup, nine outcomes (15 percent) showed a statistically significant difference in effects for groups of families split by number of demographic risk factors.¹⁵

Those nine outcomes contribute to six research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors (three differences out of 20 tests); (2) maternal mental and behavioral health (three differences out of seven tests); (3) parent-child interactions (three differences out of 18 tests); (4) family conflict, intimate partner violence, aggression, and child maltreatment (two differences out of nine tests); (5) children’s social-emotional functioning in the home context (three differences out of eight tests); and (6) children’s social-emotional functioning in school settings (one difference out of nine tests).¹⁶

In each of these research questions, when these differences are examined *within* subgroup category, the results suggest that there may be a set of more favorable effects for mothers who reported lower demographic risk and less favorable effects for mothers who reported higher demographic risk at study entry. However, the exploratory nature of this analysis makes it challenging to interpret what could be driving these results. Additionally, the smaller sample size for the higher demographic risk group may also result in a relative lack of precision, and thus, caution is warranted when interpreting these findings.

Parity

Appendix Tables F.42 through F.49 present findings for the subgroup defined by parity—whether the woman was to be a first-time mother at study entry. The subgroup categories are defined as:

- Mothers with prior children (40.3 percent)
- First-time mothers (59.7 percent)

15. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question.

16. Additionally, two research questions did not have any significant differences in effects by mother’s number of demographic risk factors: (1) economic circumstances; and (2) children’s cognitive, language, and early math skills.

Appendix Table F.42. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.80	23.62	0.18	23.98	23.93	0.05	0.721
Perceived social support	19.40	18.95	0.46	19.43	19.16	0.27	0.717
Resource mobilization	15.31	15.23	0.08	15.13	15.47	-0.34	0.292
Parenting distress							
Parenting distress	8.68	8.78	-0.10	9.11	8.93	0.18	0.422
Parent-child relationship							
Parental warmth	5.85	5.96	-0.10	5.98	6.07	-0.09	0.958
Parent-child dysfunctional interaction	9.03	9.48	-0.46 *	9.46	9.49	-0.04	0.235
Aggression toward child							
Frequency of psychological aggression during the past year	6.14	6.42	-0.27	6.48	6.65	-0.17	0.856
Frequency of physical aggression during the past year (%)	2.71	3.15	-0.44	3.57	3.95	-0.38	0.973
Behavior toward child during semi-structured task							
Parental sensitivity	4.63	4.65	-0.02	4.65	4.63	0.02	0.702
Parental positive regard	4.37	4.39	-0.02	4.40	4.39	0.01	0.808
Parental stimulation of cognitive development	4.35	4.34	0.01	4.38	4.36	0.02	0.879
Parental intrusiveness	1.92	1.85	0.07	1.83	1.86	-0.03	0.284
Parental detachment	1.11	1.13	-0.02	1.10	1.15	-0.05 *	0.410
Parental negative regard	1.17	1.16	0.00	1.19	1.18	0.00	0.986
Parental support for learning and development							
Reads to child daily (%)	32.68	40.93	-8.25 **	43.38	37.85	5.53 *	0.003
Average amount of reading to child per day in a typical week (minutes)	20.44	21.47	-1.03	21.84	22.50	-0.66	0.785
Number of children's books in the home	55.35	51.39	3.96	48.30	45.68	2.63	0.790
Composite of in-home literacy activities	0.64	0.69	-0.06 **	0.71	0.69	0.02	0.016
Composite of in-home learning activities	0.56	0.60	-0.04 *	0.64	0.62	0.03	0.017
Percentage of days absent from school	7.67	9.04	-1.37	8.57	8.45	0.12	0.332
Sample size (total = 4,080)	824	820		1,207	1,229		

(continued)

Appendix Table F.42 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.43. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies							
Mastery	23.80	23.62	0.18	23.98	23.93	0.05	0.721
Perceived social support	19.40	18.95	0.46	19.43	19.16	0.27	0.717
Resource mobilization	15.31	15.23	0.08	15.13	15.47	-0.34	0.292
Parenting distress							
Parenting distress	8.68	8.78	-0.10	9.11	8.93	0.18	0.422
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	21.40	22.75	-1.34	25.20	22.00	3.20	0.228
Maternal substance use (%)							
Used illicit drugs	7.33	7.33	-0.01	6.56	8.96	-2.40	0.334
Excessive drinking	16.09	14.95	1.14	18.99	20.03	-1.04	0.536
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.44. Estimated Effects on Parent-Child Interactions at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship							
Parental warmth	5.85	5.96	-0.10	5.98	6.07	-0.09	0.958
Parent-child dysfunctional interaction	9.03	9.48	-0.46 *	9.46	9.49	-0.04	0.235
Aggression toward child							
Frequency of psychological aggression during the past year	6.14	6.42	-0.27	6.48	6.65	-0.17	0.856
Frequency of physical aggression during the past year (%)	2.71	3.15	-0.44	3.57	3.95	-0.38	0.973
Behavior toward child during semi-structured task							
Parental sensitivity	4.63	4.65	-0.02	4.65	4.63	0.02	0.702
Parental positive regard	4.37	4.39	-0.02	4.40	4.39	0.01	0.808
Parental stimulation of cognitive development	4.35	4.34	0.01	4.38	4.36	0.02	0.879
Parental intrusiveness	1.92	1.85	0.07	1.83	1.86	-0.03	0.284
Parental detachment	1.11	1.13	-0.02	1.10	1.15	-0.05 *	0.410
Parental negative regard	1.17	1.16	0.00	1.19	1.18	0.00	0.986
Behavior toward parent during semi-structured task							
Child engagement of parent	5.00	4.99	0.01	5.03	5.06	-0.02	0.719
Child negativity toward parent	1.26	1.24	0.01	1.28	1.27	0.01	0.955
Parental support for learning and development							
Reads to child daily (%)	32.68	40.93	-8.25 **	43.38	37.85	5.53 *	0.003
Average amount of reading to child per day in a typical week (minutes)	20.44	21.47	-1.03	21.84	22.50	-0.66	0.785
Number of children's books in the home	55.35	51.39	3.96	48.30	45.68	2.63	0.790
Composite of in-home literacy activities	0.64	0.69	-0.06 **	0.71	0.69	0.02	0.016
Composite of in-home learning activities	0.56	0.60	-0.04 *	0.64	0.62	0.03	0.017
Percentage of days absent from school	7.67	9.04	-1.37	8.57	8.45	0.12	0.332
Sample size (total = 4,080)	824	820		1,207	1,229		

(continued)

Appendix Table F.44 (continued)

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.45. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict							
Family conflict	1.64	1.68	-0.04	1.55	1.55	0.00	0.485
Intimate partner violence (%)							
Maternal experience with physical violence	2.32	5.71	-3.39 **	3.49	3.15	0.33	0.042
Maternal perpetration of physical violence	6.78	8.77	-2.00	7.80	7.27	0.53	0.319
Maternal experience with battering	2.92	5.18	-2.26	1.89	2.51	-0.62	0.327
Aggression toward child							
Frequency of psychological aggression during the past year	6.14	6.42	-0.27	6.48	6.65	-0.17	0.856
Frequency of physical aggression during the past year (%)	2.71	3.15	-0.44	3.57	3.95	-0.38	0.973
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.96	0.59	0.37	0.57	0.65	-0.08	0.561
Any substantiated report of neglect since 15 months	2.89	2.91	-0.02	2.50	1.67	0.83	0.553
Any hospitalizations for injuries or ingestions since 15 months	3.87	2.49	1.38	1.06	2.03	-0.97	0.104
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.46. Estimated Effects on Economic Circumstances at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income							
Increase in education level since study entry (%)	25.12	23.34	1.78	32.27	36.25	-3.98	0.147
Receipt of high school diploma since study entry (%)	44.21	25.87	18.34 ***	56.60	62.77	-6.17	0.004
Quarters employed in past year	2.30	2.28	0.02	2.64	2.46	0.18 **	0.191
Average quarterly earnings in the past year (\$)	3,299.57	3,097.75	201.82	3,935.37	3,651.16	284.21	0.794
Household income in the past year (\$)	30,933.26	30,252.67	680.59	31,290.67	33,094.00	-1,803.34	0.416
Material hardship							
Food insecurity (%)	21.54	24.74	-3.19	19.06	23.05	-3.99	0.854
Number of material hardships in the past year	1.30	1.48	-0.18 *	1.33	1.40	-0.07	0.422
Number of moves in past year	0.38	0.42	-0.04	0.48	0.45	0.03	0.446
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.47. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	17.43	17.18	0.25	17.65	17.45	0.20	0.893
Behavior problems							
Externalizing behaviors	10.05	10.41	-0.36	9.91	9.90	0.01	0.475
Internalizing behaviors	4.96	5.30	-0.34	5.10	5.39	-0.29	0.891
Emotional and behavioral self-regulation							
Emotional self-control	13.28	13.00	0.28	13.49	13.25	0.24	0.910
Hyperactivity/inattention	7.83	8.07	-0.24	7.96	8.12	-0.16	0.829
Attention/impulse control	2.58	2.54	0.05	2.59	2.55	0.03	0.813
Behavior toward parent during semi-structured task							
Child engagement of parent	5.00	4.99	0.01	5.03	5.06	-0.02	0.719
Child negativity toward parent	1.26	1.24	0.01	1.28	1.27	0.01	0.955
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.48. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills							
Engagement	16.21	15.43	0.78 **	15.66	15.51	0.15	0.251
Cooperation	12.85	12.44	0.41	12.30	12.27	0.02	0.485
Assertive social skills	3.27	3.32	-0.05	3.35	3.26	0.09	0.366
Behavior problems							
Externalizing behaviors	7.21	8.85	-1.64 **	8.65	7.93	0.72	0.014
Internalizing behaviors	3.76	4.35	-0.59 *	3.74	3.94	-0.20	0.397
Emotional and behavioral self-regulation							
Emotional self-control	14.93	13.91	1.02 **	14.17	14.19	-0.02	0.135
Hyperactivity/inattention	6.88	7.56	-0.68	7.52	7.48	0.04	0.266
Task orientation	3.35	3.28	0.07	3.25	3.22	0.03	0.828
Frustration tolerance	3.63	3.42	0.21 **	3.47	3.49	-0.02	0.111
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.49. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Parity

Outcome	Mothers with Prior Children			First-Time Mothers			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.93	-0.01	0.93	0.94	-0.01	0.687
Cognitive flexibility - percent correct on valid trials	0.82	0.80	0.01	0.83	0.80	0.03 *	0.529
Short-term memory	3.96	3.92	0.03	3.90	3.88	0.03	0.969
Language development							
Vocabulary knowledge	463.77	462.89	0.88	462.25	462.62	-0.37	0.377
Mathematics development							
Early numeracy and math skills	427.58	425.72	1.87	426.64	425.09	1.54	0.893
Sample size (total = 4,080)	824	820		1,207	1,229		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Of the 60 tests conducted for this subgroup, six outcomes (10 percent) showed a statistically significant difference in effects for groups of families split by whether the woman was to be a first-time mother at study entry.¹⁷ However, due to the small number of statistically significant differences overall, the results by individual research question did not warrant interpretation. The tests for those six outcomes could show statistical significance based on sampling error alone.

Child's Gestational Age at Enrollment

Appendix Tables F.50 through F.57 present findings for the subgroup defined by the child's gestational age—how many weeks into her pregnancy a woman was when she enrolled in MIHOPE or if she had already given birth. The subgroup categories reflect the gestational age of the child at the time the mother entered the study and are defined as:

- Up to the twenty-eighth week of pregnancy (52.9 percent)
- After the twenty-eighth week of pregnancy (13.2 percent)
- After birth (33.8 percent)

Of the 60 tests conducted for this subgroup, seven outcomes (12 percent) showed a statistically significant difference in effects for groups of families split by the child's gestational age at study entry.¹⁸

Those seven outcomes contribute to five research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors (three differences out of 20 tests); (2) maternal mental and behavioral health (one difference out of seven tests); (3) parent-child interactions (three differences out of 18 tests); (4) children's social-emotional functioning in school settings (two differences out of nine tests); (5) children's cognitive, language, and early math skills (one difference out of five tests).¹⁹

17. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question. The six outcomes that had statistically significant differences in effects by whether the mother was to be a first-time mother at study entry contribute to five research questions: (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors; (2) parent-child interactions; (3) family conflict, intimate partner violence, aggression, and child maltreatment; (4) economic circumstances; and (5) children's social-emotional functioning in school settings. Additionally, three research questions did not have any significant differences in effects by whether the woman was a first-time mother at study entry: (1) maternal mental and behavioral health; (2) children's social-emotional functioning in the home context; and (3) children's cognitive, language, and early math skills.

18. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question.

19. Additionally, three research questions did not have any significant differences in effects by the child's gestational age at enrollment: (1) family conflict, intimate partner violence, aggression, and child maltreatment; (2) economic circumstances; and (3) children's social-emotional functioning in the home context.

Appendix Table F.50. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	23.61	0.43 *	23.84	23.88	-0.03	23.79	23.89	-0.10	0.397
Perceived social support	19.71	19.12	0.60	19.40	19.12	0.28	19.01	18.92	0.09	0.697
Resource mobilization	15.33	15.42	-0.09	14.81	14.91	-0.11	15.06	15.51	-0.45	0.747
Parenting distress										
Parenting distress	8.84	9.07	-0.23	9.10	8.44	0.66	8.87	8.89	-0.02	0.318
Parent-child relationship										
Parental warmth	5.99	5.92	0.07	5.71	5.78	-0.07	5.98	6.20	-0.22	0.348
Parent-child dysfunctional interaction	9.10	9.60	-0.51 *	9.68	9.45	0.23	9.14	9.61	-0.46	0.518
Aggression toward child										
Frequency of psychological aggression during the past year	5.99	6.79	-0.80 *	6.70	6.04	0.66	6.38	6.72	-0.34	0.303
Frequency of physical aggression during the past year (%)	2.58	3.32	-0.74	3.30	7.27	-3.97	3.29	3.22	0.07	0.561
Behavior toward child during semi-structured task										
Parental sensitivity	4.65	4.63	0.03	4.45	4.59	-0.14	4.77	4.62	0.14	0.349
Parental positive regard	4.42	4.35	0.07	4.41	4.31	0.10	4.43	4.38	0.04	0.939
Parental stimulation of cognitive development	4.35	4.35	0.00	4.26	4.27	-0.01	4.46	4.38	0.07	0.770
Parental intrusiveness	1.81	1.82	-0.01	1.94	1.81	0.14	1.90	1.92	-0.03	0.690
Parental detachment	1.08	1.15	-0.07 *	1.11	1.14	-0.03	1.13	1.12	0.01	0.368
Parental negative regard	1.15	1.17	-0.02	1.20	1.16	0.04	1.21	1.18	0.02	0.692

(continued)

Appendix Table F.50 (continued)

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	40.47	35.31	5.17	38.64	39.20	-0.57	35.60	45.00	-9.40 **	0.019
Average amount of reading to child per day in a typical week (minutes)	21.50	21.88	-0.38	22.83	21.78	1.05	20.72	21.99	-1.28	0.694
Number of children's books in the home	48.95	43.43	5.52	55.45	47.22	8.23	54.60	53.20	1.40	0.692
Composite of in-home literacy activities	0.69	0.67	0.01	0.68	0.67	0.01	0.66	0.72	-0.06 **	0.090
Composite of in-home learning activities	0.63	0.60	0.03	0.58	0.62	-0.04	0.59	0.62	-0.02	0.196
Percentage of days absent from school	8.69	9.21	-0.53	4.92	12.41	-7.49 **	9.38	6.28	3.10 **	0.004
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.51. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	23.61	0.43 *	23.84	23.88	-0.03	23.79	23.89	-0.10	0.397
Perceived social support	19.71	19.12	0.60	19.40	19.12	0.28	19.01	18.92	0.09	0.697
Resource mobilization	15.33	15.42	-0.09	14.81	14.91	-0.11	15.06	15.51	-0.45	0.747
Parenting distress										
Parenting distress	8.84	9.07	-0.23	9.10	8.44	0.66	8.87	8.89	-0.02	0.318
Maternal depressive symptoms (%)										
Exhibits depressive symptoms	22.62	24.90	-2.27	27.55	22.63	4.92	20.76	21.87	-1.11	0.618
Maternal substance use (%)										
Used illicit drugs	6.94	9.39	-2.45	12.78	4.66	8.13 *	5.23	7.76	-2.53	0.064
Excessive drinking	19.40	20.20	-0.80	13.68	21.10	-7.42	16.96	14.32	2.64	0.286
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.52. Estimated Effects on Parent-Child Interactions at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship										
Parental warmth	5.99	5.92	0.07	5.71	5.78	-0.07	5.98	6.20	-0.22	0.348
Parent-child dysfunctional interaction	9.10	9.60	-0.51 *	9.68	9.45	0.23	9.14	9.61	-0.46	0.518
Aggression toward child										
Frequency of psychological aggression during the past year	5.99	6.79	-0.80 *	6.70	6.04	0.66	6.38	6.72	-0.34	0.303
Frequency of physical aggression during the past year (%)	2.58	3.32	-0.74	3.30	7.27	-3.97	3.29	3.22	0.07	0.561
Behavior toward child during semi-structured task										
Parental sensitivity	4.65	4.63	0.03	4.45	4.59	-0.14	4.77	4.62	0.14	0.349
Parental positive regard	4.42	4.35	0.07	4.41	4.31	0.10	4.43	4.38	0.04	0.939
Parental stimulation of cognitive development	4.35	4.35	0.00	4.26	4.27	-0.01	4.46	4.38	0.07	0.770
Parental intrusiveness	1.81	1.82	-0.01	1.94	1.81	0.14	1.90	1.92	-0.03	0.690
Parental detachment	1.08	1.15	-0.07 *	1.11	1.14	-0.03	1.13	1.12	0.01	0.368
Parental negative regard	1.15	1.17	-0.02	1.20	1.16	0.04	1.21	1.18	0.02	0.692
Behavior toward parent during semi-structured task										
Child engagement of parent	5.04	5.09	-0.05	4.91	4.86	0.05	5.08	4.94	0.13	0.251
Child negativity toward parent	1.24	1.24	-0.01	1.24	1.34	-0.10	1.29	1.28	0.01	0.747

(continued)

Appendix Table F.52 (continued)

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	40.47	35.31	5.17	38.64	39.20	-0.57	35.60	45.00	-9.40 **	0.019
Average amount of reading to child per day in a typical week (minutes)	21.50	21.88	-0.38	22.83	21.78	1.05	20.72	21.99	-1.28	0.694
Number of children's books in the home	48.95	43.43	5.52	55.45	47.22	8.23	54.60	53.20	1.40	0.692
Composite of in-home literacy activities	0.69	0.67	0.01	0.68	0.67	0.01	0.66	0.72	-0.06 **	0.090
Composite of in-home learning activities	0.63	0.60	0.03	0.58	0.62	-0.04	0.59	0.62	-0.02	0.196
Percentage of days absent from school	8.69	9.21	-0.53	4.92	12.41	-7.49 **	9.38	6.28	3.10 **	0.004
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.53. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict										
Family conflict	1.54	1.59	-0.04	1.63	1.58	0.04	1.64	1.64	0.00	0.571
Intimate partner violence (%)										
Maternal experience with physical violence	3.03	3.98	-0.94	3.41	3.01	0.41	1.91	5.99	-4.08 **	0.208
Maternal perpetration of physical violence	7.57	7.10	0.47	7.36	6.20	1.17	7.00	9.52	-2.52	0.529
Maternal experience with battering	2.31	2.65	-0.34	1.76	3.93	-2.17	3.20	4.20	-1.01	0.779
Aggression toward child										
Frequency of psychological aggression during the past year	5.99	6.79	-0.80 *	6.70	6.04	0.66	6.38	6.72	-0.34	0.303
Frequency of physical aggression during the past year (%)	2.58	3.32	-0.74	3.30	7.27	-3.97	3.29	3.22	0.07	0.561
Child maltreatment (%)										
Any substantiated report of abuse since 15 months	0.71	0.25	0.47	-0.03	0.58	-0.61	0.65	1.61	-0.96	0.256
Any substantiated report of neglect since 15 months	2.15	2.73	-0.58	2.06	1.81	0.25	3.10	1.97	1.13	0.599
Any hospitalizations for injuries or ingestions since 15 months	1.16	0.55	0.61	1.99	3.45	-1.46	4.15	3.71	0.44	0.743
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.54. Estimated Effects on Economic Circumstances at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income										
Increase in education level since study entry (%)	31.73	34.29	-2.56	23.23	30.68	-7.44	26.14	27.07	-0.93	0.704
Receipt of high school diploma since study entry (%)	51.03	56.73	-5.71	44.26	38.10	6.16	46.45	40.13	6.32	0.466
Quarters employed in past year	2.57	2.42	0.16 *	2.31	2.40	-0.09	2.38	2.45	-0.07	0.234
Average quarterly earnings in the past year (\$)	3,869.31	3,490.78	378.52 *	3,330.69	3,322.57	8.12	3,397.48	3,524.94	-127.46	0.370
Household income in the past year (\$)	30,075.21	30,684.90	-609.68	36,009.32	28,053.43	7,955.89	31,555.15	34,040.29	-2,485.15	0.191
Material hardship										
Food insecurity (%)	19.81	22.34	-2.53	26.87	17.17	9.70	21.41	25.20	-3.79	0.236
Number of material hardships in the past year	1.27	1.37	-0.10	1.55	1.24	0.32	1.39	1.52	-0.13	0.238
Number of moves in past year	0.44	0.39	0.04	0.59	0.49	0.10	0.42	0.44	-0.02	0.735
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.55. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	17.48	17.38	0.10	17.65	17.43	0.21	17.65	17.20	0.45	0.649
Behavior problems										
Externalizing behaviors	9.96	9.84	0.12	10.00	10.02	-0.03	9.93	10.58	-0.64	0.426
Internalizing behaviors	5.22	5.15	0.07	5.14	5.05	0.09	4.88	5.58	-0.70 **	0.162
Emotional and behavioral self-regulation										
Emotional self-control	13.28	13.28	0.00	13.54	13.48	0.06	13.49	12.91	0.58	0.434
Hyperactivity/inattention	7.91	8.04	-0.13	8.16	7.67	0.49	7.80	8.36	-0.56 *	0.294
Attention/impulse control	2.61	2.59	0.03	2.54	2.48	0.07	2.54	2.54	0.00	0.787
Behavior toward parent during semi-structured task										
Child engagement of parent	5.04	5.09	-0.05	4.91	4.86	0.05	5.08	4.94	0.13	0.251
Child negativity toward parent	1.24	1.24	-0.01	1.24	1.34	-0.10	1.29	1.28	0.01	0.747
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.56. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	15.83	15.47	0.36	17.04	14.73	2.31 *	15.64	15.68	-0.04	0.226
Cooperation	12.51	12.41	0.09	13.49	11.47	2.03 *	12.56	12.32	0.25	0.248
Assertive social skills	3.38	3.28	0.10	3.46	3.09	0.37	3.25	3.29	-0.04	0.550
Behavior problems										
Externalizing behaviors	7.97	7.94	0.03	6.96	8.17	-1.21	8.31	8.95	-0.64	0.729
Internalizing behaviors	3.85	4.00	-0.15	2.04	4.87	-2.83 ***	4.02	4.18	-0.16	0.016
Emotional and behavioral self-regulation										
Emotional self-control	14.60	14.34	0.27	15.80	12.47	3.32 **	14.55	13.74	0.81	0.127
Hyperactivity/inattention	7.15	7.35	-0.19	6.88	7.75	-0.87	7.36	7.74	-0.38	0.882
Task orientation	3.29	3.29	0.00	3.61	2.98	0.63 *	3.29	3.22	0.08	0.187
Frustration tolerance	3.57	3.52	0.05	3.89	3.04	0.85 ***	3.51	3.42	0.10	0.044
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.57. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Gestational Age

Outcome	Entered Study Up to 28th Week of Pregnancy			Entered Study After 28th Week of Pregnancy			Entered Study After Birth			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills										
Inhibitory control - percent correct on valid trials	0.93	0.94	0.00	0.92	0.95	-0.03	0.92	0.93	-0.01	0.714
Cognitive flexibility - percent correct on valid trials	0.81	0.79	0.02	0.80	0.85	-0.05	0.83	0.81	0.02	0.257
Short-term memory	3.84	3.94	-0.10 *	3.94	3.74	0.20	4.02	3.93	0.09	0.055
Language development										
Vocabulary knowledge	461.95	463.67	-1.72	460.71	462.83	-2.11	463.42	462.86	0.56	0.325
Mathematics development										
Early numeracy and math skills	426.14	426.47	-0.33	425.03	424.39	0.64	427.12	426.00	1.13	0.864
Sample size (total = 4,094)	1,109	1,058		261	281		667	718		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

For these research questions, when these differences were examined *within* subgroup category, the results indicate that the differences in effects are mixed. The differences in effects do not suggest that effects are systematically more or less favorable for any of the categories of families.

Mother's Race and Ethnicity

Appendix Tables F.58 through F.65 present findings for the subgroup defined by maternal race and ethnicity.²⁰ The subgroup categories are defined as:

- Non-Hispanic, White (28.9 percent)
- Non-Hispanic, Black (31.3 percent)
- Hispanic (39.8 percent)

Of the 60 tests conducted for this subgroup, 6 outcomes (10 percent) showed a statistically significant difference in effects for groups of families split by the mother's race or ethnicity.²¹ However, due to the small number of statistically significant differences overall, the results by individual research question did not warrant interpretation. The tests for those six outcomes could show statistical significance based on sampling error alone.

20. For the kindergarten subgroup analysis, the study team did not include families in the "Other or multiracial" category in the analysis because they represented less than 10 percent of the sample. The "Mexican origin" and "Other Hispanic" categories were combined to align with more commonly used categories in the subgroup literature.

21. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question. The six outcomes that had statistically significant differences in effects by the mother's race or ethnicity contribute to five research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors; (2) maternal mental and behavioral health; (3) parent-child interactions; (4) family conflict, intimate partner violence, aggression, and child maltreatment; and (5) children's cognitive, language, and early math skills. Additionally, three research questions did not have any significant differences in effects by mother's race or ethnicity: (1) economic circumstances; (2) children's social-emotional functioning in the home context; and (3) children's social-emotional functioning in school settings.

Appendix Table F.58. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting From Direct Interaction Between Parents and Home Visitors, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	23.73	0.31	24.14	23.80	0.34	24.01	23.74	0.27	0.984
Perceived social support	20.01	19.26	0.75	19.00	18.18	0.81 *	19.99	19.09	0.90 **	0.969
Resource mobilization	15.77	16.06	-0.29	14.66	14.66	0.00	15.49	15.25	0.24	0.606
Parenting distress										
Parenting distress	8.65	8.70	-0.06	9.68	9.70	-0.01	8.23	8.46	-0.23	0.847
Parent-child relationship										
Parental warmth	5.94	6.33	-0.39 **	5.52	5.60	-0.09	6.23	6.13	0.09	0.066
Parent-child dysfunctional interaction	8.92	9.48	-0.56 *	9.48	9.43	0.05	8.98	9.75	-0.77 ***	0.147
Aggression toward child										
Frequency of psychological aggression during the past year	6.84	7.87	-1.02 *	7.02	7.56	-0.54	5.12	5.37	-0.25	0.559
Frequency of physical aggression during the past year (%)	0.90	2.20	-1.30	6.25	4.99	1.26	3.38	3.11	0.28	0.479
Behavior toward child during semi-structured task										
Parental sensitivity	4.99	4.90	0.09	4.51	4.40	0.11	4.60	4.60	0.00	0.632
Parental positive regard	4.62	4.58	0.04	4.34	4.28	0.06	4.34	4.25	0.10	0.891
Parental stimulation of cognitive development	4.57	4.50	0.07	4.31	4.30	0.01	4.33	4.26	0.07	0.832
Parental intrusiveness	1.73	1.79	-0.07	1.89	1.90	-0.02	1.90	1.89	0.01	0.802
Parental detachment	1.07	1.10	-0.03	1.19	1.18	0.01	1.07	1.11	-0.04	0.700
Parental negative regard	1.17	1.20	-0.03	1.27	1.25	0.02	1.08	1.10	-0.01	0.793

(continued)

Appendix Table F.58 (continued)

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	47.97	47.18	0.79	36.73	33.65	3.08	34.96	35.47	-0.51	0.795
Average amount of reading to child per day in a typical week (minutes)	20.81	21.93	-1.12	23.29	23.50	-0.21	19.78	20.34	-0.57	0.876
Number of children's books in the home	86.26	80.64	5.62	45.85	39.54	6.31	34.52	32.12	2.40	0.682
Composite of in-home literacy activities	0.75	0.75	0.00	0.69	0.67	0.02	0.64	0.65	-0.01	0.722
Composite of in-home learning activities	0.62	0.62	0.00	0.64	0.63	0.01	0.58	0.57	0.01	0.973
Percentage of days absent from school	8.94	7.32	1.62	8.28	9.49	-1.21	8.77	6.72	2.05	0.070
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.59. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Maternal coping strategies										
Mastery	24.03	23.73	0.31	24.14	23.80	0.34	24.01	23.74	0.27	0.984
Perceived social support	20.01	19.26	0.75	19.00	18.18	0.81 *	19.99	19.09	0.90 **	0.969
Resource mobilization	15.77	16.06	-0.29	14.66	14.66	0.00	15.49	15.25	0.24	0.606
Parenting distress										
Parenting distress	8.65	8.70	-0.06	9.68	9.70	-0.01	8.23	8.46	-0.23	0.847
Maternal depressive symptoms (%)										
Exhibits depressive symptoms	28.43	26.64	1.79	28.65	28.94	-0.29	13.11	16.51	-3.40	0.503
Maternal substance use (%)										
Used illicit drugs	12.13	9.44	2.69	9.33	9.72	-0.39	2.62	5.11	-2.49 *	0.243
Excessive drinking	18.41	22.18	-3.77	24.23	16.33	7.91 **	12.89	17.25	-4.36 *	0.007
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.60. Estimated Effects on Parent-Child Interactions at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parent-child relationship										
Parental warmth	5.94	6.33	-0.39 **	5.52	5.60	-0.09	6.23	6.13	0.09	0.066
Parent-child dysfunctional interaction	8.92	9.48	-0.56 *	9.48	9.43	0.05	8.98	9.75	-0.77 ***	0.147
Aggression toward child										
Frequency of psychological aggression during the past year	6.84	7.87	-1.02 *	7.02	7.56	-0.54	5.12	5.37	-0.25	0.559
Frequency of physical aggression during the past year (%)	0.90	2.20	-1.30	6.25	4.99	1.26	3.38	3.11	0.28	0.479
Behavior toward child during semi-structured task										
Parental sensitivity	4.99	4.90	0.09	4.51	4.40	0.11	4.60	4.60	0.00	0.632
Parental positive regard	4.62	4.58	0.04	4.34	4.28	0.06	4.34	4.25	0.10	0.891
Parental stimulation of cognitive development	4.57	4.50	0.07	4.31	4.30	0.01	4.33	4.26	0.07	0.832
Parental intrusiveness	1.73	1.79	-0.07	1.89	1.90	-0.02	1.90	1.89	0.01	0.802
Parental detachment	1.07	1.10	-0.03	1.19	1.18	0.01	1.07	1.11	-0.04	0.700
Parental negative regard	1.17	1.20	-0.03	1.27	1.25	0.02	1.08	1.10	-0.01	0.793
Behavior toward parent during semi-structured task										
Child engagement of parent	5.07	4.97	0.10	4.79	4.91	-0.12	5.17	5.18	-0.01	0.252
Child negativity toward parent	1.27	1.35	-0.08	1.27	1.27	0.00	1.22	1.20	0.02	0.465

(continued)

Appendix Table F.60 (continued)

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Parental support for learning and development										
Reads to child daily (%)	47.97	47.18	0.79	36.73	33.65	3.08	34.96	35.47	-0.51	0.795
Average amount of reading to child per day in a typical week (minutes)	20.81	21.93	-1.12	23.29	23.50	-0.21	19.78	20.34	-0.57	0.876
Number of children's books in the home	86.26	80.64	5.62	45.85	39.54	6.31	34.52	32.12	2.40	0.682
Composite of in-home literacy activities	0.75	0.75	0.00	0.69	0.67	0.02	0.64	0.65	-0.01	0.722
Composite of in-home learning activities	0.62	0.62	0.00	0.64	0.63	0.01	0.58	0.57	0.01	0.973
Percentage of days absent from school	8.94	7.32	1.62	8.28	9.49	-1.21	8.77	6.72	2.05	0.070
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.61. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Family conflict										
Family conflict	1.53	1.62	-0.08 *	1.66	1.68	-0.01	1.54	1.56	-0.02	0.517
Intimate partner violence (%)										
Maternal experience with physical violence	3.63	4.43	-0.81	2.42	3.04	-0.63	1.91	5.53	-3.62 ***	0.242
Maternal perpetration of physical violence	5.44	7.14	-1.70	9.45	6.09	3.36	6.29	9.30	-3.02	0.079
Maternal experience with battering	2.42	2.50	-0.08	1.11	2.93	-1.82	2.68	5.10	-2.42 *	0.489
Aggression toward child										
Frequency of psychological aggression during the past year	6.84	7.87	-1.02 *	7.02	7.56	-0.54	5.12	5.37	-0.25	0.559
Frequency of physical aggression during the past year (%)	0.90	2.20	-1.30	6.25	4.99	1.26	3.38	3.11	0.28	0.479
Child maltreatment (%)										
Any substantiated report of abuse since 15 months	0.45	1.51	-1.06	0.80	0.52	0.28	0.64	0.40	0.23	0.447
Any substantiated report of neglect since 15 months	3.42	6.41	-3.00	2.77	0.69	2.08 **	1.75	0.96	0.79	0.070
Any hospitalizations for injuries or ingestions since 15 months	1.62	1.40	0.22	3.44	1.82	1.62	2.50	2.22	0.28	0.680
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.62. Estimated Effects on Economic Circumstances at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Education, employment, and income										
Increase in education level since study entry (%)	22.94	29.05	-6.12	32.05	29.02	3.03	29.83	32.29	-2.46	0.203
Receipt of high school diploma since study entry (%)	39.80	61.32	-21.52 *	63.25	53.64	9.61	41.59	41.88	-0.29	0.100
Quarters employed in past year	2.37	2.22	0.15	2.73	2.62	0.11	2.49	2.30	0.19 *	0.870
Average quarterly earnings in the past year (\$)	3,440.59	2,987.22	453.36 *	3,691.92	3,416.04	275.89	4,012.40	3,952.27	60.13	0.622
Household income in the past year (\$)	39,023.70	35,501.19	3,522.50	21,819.59	23,698.92	-1,879.33	33,784.12	34,935.24	-1,151.12	0.421
Material hardship										
Food insecurity (%)	23.10	30.34	-7.24	22.56	22.72	-0.16	15.47	20.26	-4.79	0.452
Number of material hardships in the past year	1.37	1.57	-0.21	1.70	1.76	-0.05	0.97	1.08	-0.11	0.714
Number of moves in past year	0.49	0.49	-0.01	0.49	0.48	0.02	0.34	0.35	-0.01	0.964
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.63. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	17.12	17.35	-0.24	17.54	17.23	0.31	17.60	17.69	-0.09	0.418
Behavior problems										
Externalizing behaviors	10.52	11.35	-0.83 *	9.82	9.60	0.22	9.30	9.80	-0.50	0.297
Internalizing behaviors	5.08	5.86	-0.78 **	5.16	5.22	-0.06	4.83	5.03	-0.21	0.300
Emotional and behavioral self-regulation										
Emotional self-control	12.85	12.57	0.28	13.18	12.82	0.36	13.93	14.00	-0.07	0.610
Hyperactivity/inattention	8.08	8.61	-0.53	7.88	7.78	0.10	7.61	8.01	-0.40	0.403
Attention/impulse control	2.53	2.52	0.01	2.54	2.47	0.07	2.66	2.64	0.02	0.599
Behavior toward parent during semi-structured task										
Child engagement of parent	5.07	4.97	0.10	4.79	4.91	-0.12	5.17	5.18	-0.01	0.252
Child negativity toward parent	1.27	1.35	-0.08	1.27	1.27	0.00	1.22	1.20	0.02	0.465
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.64. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Social skills										
Engagement	16.17	15.30	0.87 *	15.80	15.30	0.50	15.66	15.83	-0.17	0.284
Cooperation	12.41	12.21	0.19	12.19	11.77	0.42	12.94	12.97	-0.03	0.808
Assertive social skills	3.37	3.25	0.12	3.27	3.24	0.03	3.26	3.31	-0.05	0.697
Behavior problems										
Externalizing behaviors	8.96	9.28	-0.32	8.94	9.51	-0.56	6.69	6.37	0.32	0.743
Internalizing behaviors	4.45	4.43	0.02	3.98	4.44	-0.46	3.33	3.51	-0.18	0.750
Emotional and behavioral self-regulation										
Emotional self-control	14.06	13.73	0.33	14.17	13.20	0.98	14.94	15.10	-0.16	0.443
Hyperactivity/inattention	7.83	8.20	-0.37	8.00	8.18	-0.18	6.23	6.24	-0.01	0.899
Task orientation	3.27	3.21	0.06	3.19	3.08	0.11	3.41	3.37	0.04	0.923
Frustration tolerance	3.37	3.36	0.01	3.37	3.26	0.11	3.77	3.71	0.06	0.892
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table F.65. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Race and Ethnicity

Outcome	Non-Hispanic, White			Non-Hispanic, Black			Hispanic			P-Value
	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	Program Group	Control Group	Difference (Effect)	
Cognitive skills										
Inhibitory control - percent correct on valid trials	0.93	0.93	0.00	0.92	0.93	-0.01	0.92	0.95	-0.03 **	0.240
Cognitive flexibility - percent correct on valid trials	0.89	0.85	0.04 *	0.77	0.77	0.00	0.82	0.79	0.03	0.474
Short-term memory	4.06	3.88	0.18 **	4.01	4.11	-0.10	3.78	3.76	0.02	0.062
Language development										
Vocabulary knowledge	470.56	468.83	1.73	464.79	465.19	-0.41	455.82	457.12	-1.30	0.210
Mathematics development										
Early numeracy and math skills	435.93	430.62	5.30 **	422.91	422.96	-0.05	424.86	424.30	0.56	0.149
Sample size (total = 3,707)	501	571		615	545		746	729		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Subgroup effects control for evidence-based model to account for differences in the distribution of the evidence-based models within subgroups.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

CONCLUSION

Using largely the same subgroup definitions from the 15-month follow-up, this kindergarten follow-up continues to show that the effects of home visiting are largely consistent across families with different characteristics as evidenced by the lack of a pattern of effects for six of the eight subgroups. However, the kindergarten results suggest that there may be patterns of differences between subgroups of families defined by levels of psychological resources and number of demographic risk factors. For these two subgroups, the results appear to tell different stories of the longer-term effects of home visiting services based on the definition of risk used. These results are interpreted below, with the caveat that after an adjustment for conducting multiple tests was applied across all 480 comparisons (8 subgroups by 60 outcomes), no statistically significant differences in estimated effects remained.²²

To illustrate, the favorable effects of home visiting were concentrated among mothers who experienced greater psychosocial risk (as measured by lower levels of psychological resources) at study entry, showing improvement on a range of more proximal outcomes (such as coping strategies, parent-child interactions, family conflict) as compared with the effects of home visiting for mothers with less psychosocial risk. The children of mothers who experienced greater psychosocial risk at study entry also appear to have improvement on a range of more distal outcomes such as social-emotional functioning in school settings and better performance on cognitive and early math assessments. This pattern of effects was not found among mothers who experienced less psychosocial risk, as compared with those with mothers with greater psychosocial risk.

The overall pattern is different when the risk refers to demographic indicators. In this case, the benefits of home visiting were not concentrated in families with greater demographic risk at study entry. Instead, the findings suggest that experiencing a higher number of demographic risk factors at study entry may have created barriers for the potential impact that home visiting services could have. The results show a clustering of favorable effects of home visiting on program group families with lower levels of demographic risk and unfavorable effects of home visiting on program group families with higher levels of demographic risk. These results are difficult to interpret considering the exploratory nature of these analyses and the relative lack of precision of these estimates given the smaller sample size of the higher demographic risk group. Thus, the reader is cautioned not to overly interpret these findings. Nevertheless, the differences in effects by demographic risk highlight the need for future research in this area to understand under what conditions these longer-term results might be replicated. Additionally, home visiting's effects for families may vary by other characteristics that have not yet been identified by home visiting studies. Future research can try to leverage service delivery and family engagement data to better understand the interaction between risk factors and outcomes.

22. The adjustment used was the Benjamini-Hochberg adjustment. See Benjamini and Hochberg (1995).

APPENDIX

G

Sensitivity Checks to the Main Analyses

This appendix chapter presents sensitivity checks to the main impact analysis in this report, which is presented in Chapter 3. The purpose of these sensitivity checks is to understand the extent to which estimated effects are sensitive to decisions that were made in choosing an estimation model and to understand the degree to which the estimated effects are sensitive to the analytical sample for which the study team has data.

The analyses conducted include:

- Effect estimates that are not adjusted for family baseline characteristics. The main analysis adjusted estimated effects for family baseline characteristics to increase precision in the estimates. This sensitivity check assesses whether the estimated effects presented in Chapter 3 are different when the effects are not adjusted for family baseline characteristics.
- An analysis using multiple imputations to fill in missing survey, direct assessment, or administrative data on outcomes for families who did not complete follow-up data collection or who could not be found in administrative data records. The analysis presented in Chapter 3 used data for families who completed the caregiver survey, direct assessments, or teacher survey or who could be found in administrative data records. This sensitivity check imputed missing data for families and assessed the extent to which the effects are influenced by missing data.
- Effect estimates limited to the sample of families who responded to all follow-up survey waves. The analysis presented in Chapter 3 used data for all families who responded to the caregiver survey and direct assessments, regardless of past study participation. This sensitivity check limited the sample to families who responded to all follow-up waves (15-month survey and in-home assessment, 2.5-year check-in survey, 3.5-year check-in survey, kindergarten caregiver survey, and kindergarten direct assessments). This sensitivity check assessed whether there are any differences in the effects for families who have been more engaged in the study over time and whether differences in the findings across data sources were due to different samples of families or not.

The study team's assessment of differences in the results between the main analysis and these sensitivity checks focuses on changes in the direction of the effects and the significance level of the effects (which capture changes in the magnitude and strength of effects). These types of differences were assessed to determine whether findings were substantially different from the main analyses. In general, the results of the sensitivity checks listed above are similar to the estimated effects presented in Chapter 3 and suggest that the main findings are not sensitive to the analytical decisions made by the study team.

ESTIMATED EFFECTS UNADJUSTED FOR FAMILY BASELINE CHARACTERISTICS

Appendix Tables G.1 through G.8 show effect estimates that are not adjusted for family baseline characteristics. The effect estimates for the main analysis shown in Chapter 3 are adjusted for several family baseline characteristics to increase precision in the models. Covariates in the regression adjustment include the following maternal characteristics: age; race, ethnicity, and place of birth; depression or anxiety; food security; education; substance use before pregnancy; marital status; number of children in the household; perpetration of physical violence; experience of physical or sexual violence; whether the mother was receiving education or training; employment; receipt of benefits from the Supplemental Nutrition Assistance Program, Supplemental Security Income, Temporary Assistance for Needy Families, or the Special Supplemental Nutrition Program for Women, Infants, and Children; verbal abstract reasoning; previous arrest; health status; health insurance coverage; smoking before pregnancy; previous receipt of behavioral health services; whether the mother was pregnant when she entered the study; receipt of domestic violence services; whether any child had involvement with child welfare services; relationship quality; English proficiency; empathy; experience with battering; verbal skills; home interior; parental warmth; lack of hostility; mastery; and which home visiting program enrolled the mother. Covariates also included child sex and, for children who were born before they entered the study, child temperament, whether the child had a usual source of care, whether the child had poor health at birth, and the child's age at enrollment.

Using models unadjusted for these covariates is not expected to lead to estimates that are systematically different.

The results in Appendix Tables G.1 through G.8 are generally consistent with the estimated effects shown in Chapter 3. For three outcomes, the estimated effects change directions; however, the effects are small and not statistically significant in either analysis. For eight outcomes, the estimated effect is either statistically significant in the main analysis but not in the non-regression-adjusted sensitivity check (three outcomes) or is not statistically significant in the main analysis but is in the non-regression-adjusted sensitivity check (five outcomes). These changes in p-values are small and the outcomes for which significance levels changed had p-values that are close to 0.10 (the study's threshold for statistical significance). Given these small changes in the magnitude and strength of the effects, the results from the non-regression-adjusted sensitivity check yield similar findings to the main analysis findings.

Appendix Table G.1. Non-Regression-Adjusted Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.97	23.71	0.27	0.08	0.118	-0.01	0.55
Perceived social support	19.57	18.91	0.66	0.13	0.006	0.26	1.06
Resource mobilization	15.31	15.26	0.04	0.01	0.809	-0.25	0.34
Parenting distress							
Parenting distress	8.87	8.93	-0.06	-0.02	0.714	-0.32	0.21
Parent-child relationship							
Parental warmth	5.93	6.02	-0.10	-0.05	0.225	-0.23	0.03
Parent-child dysfunctional interaction	9.17	9.60	-0.43	-0.11	0.012	-0.71	-0.15
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.63	-0.40	-0.06	0.132	-0.84	0.04
Frequency of physical aggression during the past year (%)	3.29	3.49	-0.20	-0.01	0.796	-1.45	1.05
Behavior toward child during semi-structured task							
Parental sensitivity	4.68	4.61	0.07	0.07	0.127	-0.01	0.15
Parental positive regard	4.41	4.36	0.05	0.05	0.255	-0.02	0.12
Parental stimulation of cognitive development	4.38	4.34	0.04	0.04	0.321	-0.03	0.12
Parental intrusiveness	1.84	1.88	-0.04	-0.04	0.372	-0.10	0.03
Parental detachment	1.11	1.14	-0.03	-0.06	0.137	-0.06	0.00
Parental negative regard	1.17	1.18	-0.01	-0.03	0.520	-0.05	0.02
Parental support for learning and development							
Reads to child daily (%)	38.78	39.19	-0.41	-0.01	0.840	-3.75	2.93
Average amount of reading to child per day in a typical week (minutes)	21.44	21.86	-0.43	-0.03	0.478	-1.41	0.56
Number of children's books in the home	51.46	47.84	3.62	0.06	0.127	-0.28	7.52
Composite of in-home literacy activities	0.69	0.68	0.00	0.01	0.781	-0.02	0.03
Composite of in-home learning activities	0.62	0.60	0.01	0.04	0.384	-0.01	0.03
Percentage of days absent from school	8.52	8.37	0.15	0.02	0.780	-0.75	1.05
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.2. Non-Regression-Adjusted Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.97	23.71	0.27	0.08	0.118	-0.01	0.55
Perceived social support	19.57	18.91	0.66	0.13	0.006	0.26	1.06
Resource mobilization	15.31	15.26	0.04	0.01	0.809	-0.25	0.34
Parenting distress							
Parenting distress	8.87	8.93	-0.06	-0.02	0.714	-0.32	0.21
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	22.63	23.35	-0.73	-0.02	0.677	-3.61	2.15
Maternal substance use (%)							
Used illicit drugs	6.97	8.21	-1.24	-0.05	0.256	-3.05	0.56
Excessive drinking	18.18	17.63	0.55	0.01	0.731	-2.08	3.18
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.3. Non-Regression-Adjusted Estimated Effects on Parent-Child Interactions at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Parent-child relationship							
Parental warmth	5.93	6.02	-0.10	-0.05	0.225	-0.23	0.03
Parent-child dysfunctional interaction	9.17	9.60	-0.43	-0.11	0.012	-0.71	-0.15
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.63	-0.40	-0.06	0.132	-0.84	0.04
Frequency of physical aggression during the past year (%)	3.29	3.49	-0.20	-0.01	0.796	-1.45	1.05
Behavior toward child during semi-structured task							
Parental sensitivity	4.68	4.61	0.07	0.07	0.127	-0.01	0.15
Parental positive regard	4.41	4.36	0.05	0.05	0.255	-0.02	0.12
Parental stimulation of cognitive development	4.38	4.34	0.04	0.04	0.321	-0.03	0.12
Parental intrusiveness	1.84	1.88	-0.04	-0.04	0.372	-0.10	0.03
Parental detachment	1.11	1.14	-0.03	-0.06	0.137	-0.06	0.00
Parental negative regard	1.17	1.18	-0.01	-0.03	0.520	-0.05	0.02
Behavior toward parent during semi-structured task							
Child engagement of parent	5.04	5.00	0.04	0.05	0.304	-0.03	0.11
Child negativity toward parent	1.25	1.27	-0.02	-0.04	0.412	-0.07	0.02
Parental support for learning and development							
Reads to child daily (%)	38.78	39.19	-0.41	-0.01	0.840	-3.75	2.93
Average amount of reading to child per day in a typical week (minutes)	21.44	21.86	-0.43	-0.03	0.478	-1.41	0.56
Number of children's books in the home	51.46	47.84	3.62	0.06	0.127	-0.28	7.52
Composite of in-home literacy activities	0.69	0.68	0.00	0.01	0.781	-0.02	0.03
Composite of in-home learning activities	0.62	0.60	0.01	0.04	0.384	-0.01	0.03
Percentage of days absent from school	8.52	8.37	0.15	0.02	0.780	-0.75	1.05
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.4. Non-Regression-Adjusted Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Family conflict							
Family conflict	1.58	1.61	-0.03	-0.07	0.134	-0.07	0.00
Intimate partner violence (%)							
Maternal experience with physical violence	2.89	4.41	-1.51	-0.07	0.055	-2.81	-0.22
Maternal perpetration of physical violence	7.92	7.41	0.52	0.02	0.642	-1.31	2.35
Maternal experience with battering	2.24	3.71	-1.47	-0.08	0.039	-2.64	-0.30
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.63	-0.40	-0.06	0.132	-0.84	0.04
Frequency of physical aggression during the past year (%)	3.29	3.49	-0.20	-0.01	0.796	-1.45	1.05
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.61	0.72	-0.11	-0.01	0.726	-0.63	0.41
Any substantiated report of neglect since 15 months	2.39	2.39	0.00	0.00	0.996	-0.96	0.97
Any hospitalizations for injuries or ingestions since 15 months	2.32	2.13	0.18	0.01	0.752	-0.77	1.14
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table G.5. Non-Regression-Adjusted Estimated Effects
on Economic Circumstances at Kindergarten**

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Education, employment, and income							
Increase in education level since study entry (%)	28.93	30.90	-1.97	-0.04	0.307	-5.14	1.20
Receipt of high school diploma since study entry (%)	48.73	48.38	0.35	0.01	0.918	-5.23	5.92
Household income in the past year (\$)	31,237.52	31,754.36	-516.84	-0.02	0.728	-2,971.28	1,937.59
Material hardship							
Food insecurity (%)	20.01	23.95	-3.94	-0.09	0.042	-7.13	-0.75
Number of material hardships in the past year	1.33	1.43	-0.10	-0.07	0.120	-0.21	0.01
Number of moves in past year	0.44	0.44	0.01	0.01	0.892	-0.06	0.07
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.6. Non-Regression-Adjusted Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	17.53	17.35	0.18	0.05	0.232	-0.07	0.42
Behavior problems							
Externalizing behaviors	9.80	10.29	-0.49	-0.08	0.047	-0.89	-0.08
Internalizing behaviors	4.98	5.40	-0.42	-0.10	0.014	-0.69	-0.14
Emotional and behavioral self-regulation							
Emotional self-control	13.42	13.14	0.28	0.07	0.125	-0.02	0.58
Hyperactivity/inattention	7.79	8.23	-0.44	-0.11	0.012	-0.73	-0.15
Attention/impulse control	2.58	2.55	0.04	0.06	0.101	0.00	0.07
Behavior toward parent during semi-structured task							
Child engagement of parent	5.04	5.00	0.04	0.05	0.304	-0.03	0.11
Child negativity toward parent	1.25	1.27	-0.02	-0.04	0.412	-0.07	0.02
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.7. Non-Regression-Adjusted Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	15.82	15.55	0.27	0.06	0.266	-0.13	0.67
Cooperation	12.51	12.39	0.12	0.03	0.621	-0.28	0.52
Assertive social skills	3.31	3.29	0.02	0.02	0.731	-0.09	0.14
Behavior problems							
Externalizing behaviors	8.07	8.27	-0.20	-0.03	0.630	-0.90	0.49
Internalizing behaviors	3.76	4.12	-0.36	-0.10	0.066	-0.68	-0.04
Emotional and behavioral self-regulation							
Emotional self-control	14.50	14.06	0.44	0.08	0.152	-0.07	0.95
Hyperactivity/inattention	7.26	7.48	-0.22	-0.04	0.448	-0.69	0.26
Task orientation	3.29	3.26	0.04	0.03	0.585	-0.07	0.14
Frustration tolerance	3.54	3.46	0.08	0.07	0.229	-0.03	0.19
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table G.8. Non-Regression-Adjusted Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.94	-0.01	-0.08	0.113	-0.03	0.00
Cognitive flexibility - percent correct on valid trials	0.82	0.80	0.02	0.07	0.114	0.00	0.03
Short-term memory	3.92	3.90	0.02	0.03	0.545	-0.04	0.09
Language development							
Vocabulary knowledge	462.68	462.92	-0.24	-0.01	0.722	-1.33	0.86
Mathematics development							
Early numeracy and math skills	426.64	425.73	0.91	0.03	0.403	-0.89	2.71
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

ANALYSIS USING MULTIPLE IMPUTATIONS TO FILL IN MISSING DATA

Appendix Tables G.9 through G.16 show estimated effects for the full MIHOPE sample, using multiple imputations to fill in missing data for families who did not complete the caregiver survey, direct assessments, or teacher surveys or for families who did not match to administrative data records. Missing data were imputed using other data collected at kindergarten and select baseline characteristics. Imputing missing data helps determine the degree to which the estimated effects are affected by families not responding to direct data collection or families not being found in administrative data records, either due to a lack of identifiers available for matching purposes or the study team's ability to acquire data from various sources. Differences in estimated effects using imputed data are more likely if families without data significantly differ from families with data on baseline characteristics and if estimated effects vary based on baseline characteristics. See Appendix B for an assessment of how families who responded and did not respond to direct data collection differ on select baseline characteristics, and Appendix F for a discussion of the extent to which estimated effects vary based on baseline characteristics.

The findings using the imputed data are similar to those presented in Chapter 3. For four outcomes, the estimated effects change directions; however, the effects are small and not statistically significant in either analysis. For seven outcomes, the estimated effect is either statistically significant in the main analysis but not in the multiple imputation sensitivity check (two outcomes) or is not statistically significant in the main analysis but is in the multiple imputation sensitivity check (five outcomes). These changes in the p-values are small such that the results from the multiple imputation sensitivity check yield similar findings to the main analysis findings.

Appendix Table G.9. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.90	23.76	0.15	0.04	0.280	-0.08	0.37
Perceived social support	19.50	18.93	0.57	0.11	0.013	0.20	0.95
Resource mobilization	15.28	15.24	0.04	0.01	0.823	-0.27	0.36
Parenting distress							
Parenting distress	8.94	8.94	0.00	0.00	0.989	-0.24	0.23
Parent-child relationship							
Parental warmth	5.90	5.95	-0.05	-0.03	0.518	-0.19	0.08
Parent-child dysfunctional interaction	9.23	9.58	-0.35	-0.09	0.041	-0.63	-0.07
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.61	-0.38	-0.06	0.151	-0.81	0.06
Frequency of physical aggression during the past year (%)	3.45	3.63	-0.18	-0.01	0.807	-1.36	1.01
Behavior toward child during semi-structured task							
Parental sensitivity	4.64	4.58	0.06	0.05	0.258	-0.03	0.14
Parental positive regard	4.37	4.35	0.03	0.03	0.553	-0.05	0.10
Parental stimulation of cognitive development	4.34	4.32	0.02	0.02	0.559	-0.04	0.09
Parental intrusiveness	1.84	1.87	-0.03	-0.03	0.477	-0.10	0.04
Parental detachment	1.12	1.15	-0.03	-0.06	0.123	-0.06	0.00
Parental negative regard	1.17	1.19	-0.02	-0.03	0.412	-0.05	0.02
Parental support for learning and development							
Reads to child daily (%)	38.85	39.22	-0.37	-0.01	0.844	-3.47	2.72
Average amount of reading to child per day in a typical week (minutes)	21.76	22.14	-0.39	-0.03	0.487	-1.31	0.53
Number of children's books in the home	51.32	47.63	3.69	0.06	0.068	0.37	7.01
Composite of in-home literacy activities	0.68	0.68	0.00	0.01	0.853	-0.02	0.03
Composite of in-home learning activities	0.61	0.61	0.00	0.01	0.772	-0.02	0.02
Percentage of days absent from school	8.82	8.81	0.00	0.00	0.995	-0.88	0.89
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

Appendix Table G.10. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.90	23.76	0.15	0.04	0.280	-0.08	0.37
Perceived social support	19.50	18.93	0.57	0.11	0.013	0.20	0.95
Resource mobilization	15.28	15.24	0.04	0.01	0.823	-0.27	0.36
Parenting distress							
Parenting distress	8.94	8.94	0.00	0.00	0.989	-0.24	0.23
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	24.18	23.99	0.19	0.00	0.904	-2.40	2.78
Maternal substance use (%)							
Used illicit drugs	7.79	8.39	-0.60	-0.02	0.615	-2.57	1.37
Excessive drinking	18.90	18.47	0.43	0.01	0.793	-2.27	3.13
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

**Appendix Table G.11. Estimated Effects on Parent-Child Interactions
at Kindergarten, Calculated with Multiple Imputation**

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Parent-child relationship							
Parental warmth	5.90	5.95	-0.05	-0.03	0.518	-0.19	0.08
Parent-child dysfunctional interaction	9.23	9.58	-0.35	-0.09	0.041	-0.63	-0.07
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.61	-0.38	-0.06	0.151	-0.81	0.06
Frequency of physical aggression during the past year (%)	3.45	3.63	-0.18	-0.01	0.807	-1.36	1.01
Behavior toward child during semi-structured task							
Parental sensitivity	4.64	4.58	0.06	0.05	0.258	-0.03	0.14
Parental positive regard	4.37	4.35	0.03	0.03	0.553	-0.05	0.10
Parental stimulation of cognitive development	4.34	4.32	0.02	0.02	0.559	-0.04	0.09
Parental intrusiveness	1.84	1.87	-0.03	-0.03	0.477	-0.10	0.04
Parental detachment	1.12	1.15	-0.03	-0.06	0.123	-0.06	0.00
Parental negative regard	1.17	1.19	-0.02	-0.03	0.412	-0.05	0.02
Behavior toward parent during semi-structured task							
Child engagement of parent	5.01	4.98	0.03	0.03	0.448	-0.04	0.10
Child negativity toward parent	1.26	1.28	-0.01	-0.02	0.594	-0.06	0.03
Parental support for learning and development							
Reads to child daily (%)	38.85	39.22	-0.37	-0.01	0.844	-3.47	2.72
Average amount of reading to child per day in a typical week (minutes)	21.76	22.14	-0.39	-0.03	0.487	-1.31	0.53
Number of children's books in the home	51.32	47.63	3.69	0.06	0.068	0.37	7.01
Composite of in-home literacy activities	0.68	0.68	0.00	0.01	0.853	-0.02	0.03
Composite of in-home learning activities	0.61	0.61	0.00	0.01	0.772	-0.02	0.02
Percentage of days absent from school	8.82	8.81	0.00	0.00	0.995	-0.88	0.89
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

Appendix Table G.12. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Family conflict							
Family conflict	1.59	1.61	-0.02	-0.04	0.344	-0.06	0.02
Intimate partner violence (%)							
Maternal experience with physical violence	3.27	4.39	-1.12	-0.05	0.173	-2.47	0.23
Maternal perpetration of physical violence	8.41	7.59	0.82	0.03	0.458	-1.00	2.64
Maternal experience with battering	2.50	3.70	-1.20	-0.06	0.098	-2.38	-0.01
Aggression toward child							
Frequency of psychological aggression during the past year	6.23	6.61	-0.38	-0.06	0.151	-0.81	0.06
Frequency of physical aggression during the past year (%)	3.45	3.63	-0.18	-0.01	0.807	-1.36	1.01
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.80	0.94	-0.14	-0.01	0.697	-0.75	0.46
Any substantiated report of neglect since 15 months	2.83	2.66	0.17	0.01	0.796	-0.92	1.26
Any hospitalizations for injuries or ingestions since 15 months	2.22	2.32	-0.10	-0.01	0.875	-1.18	0.97
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

**Appendix Table G.13. Estimated Effects on Economic Circumstances
at Kindergarten, Calculated with Multiple Imputation**

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Education, employment, and income							
Increase in education level since study entry (%)	27.89	30.90	-3.02	-0.07	0.087	-5.91	-0.12
Receipt of high school diploma since study entry (%)	42.78	46.09	-3.31	-0.07	0.256	-8.11	1.49
Household income in the past year (\$)	31,063.62	31,519.65	-456.03	-0.02	0.698	-2,397.17	1,485.11
Material hardship							
Food insecurity (%)	21.57	23.58	-2.01	-0.05	0.281	-5.09	1.07
Number of material hardships in the past year	1.37	1.46	-0.09	-0.06	0.150	-0.18	0.01
Number of moves in past year	0.46	0.45	0.01	0.02	0.723	-0.06	0.08
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

Appendix Table G.14. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	17.43	17.28	0.16	0.04	0.338	-0.11	0.43
Behavior problems							
Externalizing behaviors	9.98	10.31	-0.33	-0.05	0.154	-0.71	0.05
Internalizing behaviors	5.12	5.45	-0.33	-0.08	0.053	-0.60	-0.05
Emotional and behavioral self-regulation							
Emotional self-control	13.30	13.07	0.23	0.05	0.193	-0.06	0.52
Hyperactivity/inattention	7.90	8.19	-0.29	-0.07	0.097	-0.58	0.00
Attention/impulse control	2.58	2.55	0.03	0.05	0.167	-0.01	0.06
Behavior toward parent during semi-structured task							
Child engagement of parent	5.01	4.98	0.03	0.03	0.448	-0.04	0.10
Child negativity toward parent	1.26	1.28	-0.01	-0.02	0.594	-0.06	0.03
Sample size (total = 4,102)	2,041	2,061					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

Appendix Table G.15. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	16.00	15.71	0.29	0.07	0.232	-0.11	0.69
Cooperation	12.68	12.55	0.12	0.03	0.541	-0.21	0.46
Assertive social skills	3.34	3.29	0.05	0.05	0.341	-0.04	0.15
Behavior problems							
Externalizing behaviors	7.79	7.98	-0.19	-0.03	0.619	-0.82	0.44
Internalizing behaviors	3.77	4.08	-0.31	-0.09	0.132	-0.64	0.03
Emotional and behavioral self-regulation							
Emotional self-control	14.87	14.31	0.56	0.11	0.031	0.14	0.98
Hyperactivity/inattention	7.07	7.25	-0.18	-0.04	0.486	-0.62	0.25
Task orientation	3.33	3.28	0.04	0.04	0.445	-0.05	0.14
Frustration tolerance	3.60	3.49	0.11	0.09	0.078	0.01	0.20
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

Appendix Table G.16. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, Calculated with Multiple Imputation

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.91	0.92	-0.01	-0.05	0.331	-0.02	0.01
Cognitive flexibility - percent correct on valid trials	0.79	0.78	0.02	0.08	0.076	0.00	0.03
Short-term memory	3.89	3.87	0.03	0.03	0.485	-0.04	0.09
Language development							
Vocabulary knowledge	462.93	463.21	-0.29	-0.02	0.614	-1.22	0.65
Mathematics development							
Early numeracy and math skills	426.40	425.43	0.97	0.03	0.359	-0.77	2.72
Sample size (total = 4,102)	2,041	2,061					

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

ESTIMATED EFFECTS FOR FAMILIES WHO RESPONDED TO ALL SURVEY WAVES

Appendix Tables G.17 through G.24 show estimated effects for the sample of families who responded to all survey waves (15-month survey and in-home assessment, 2.5-year check-in survey, 3.5-year check-in survey, kindergarten caregiver survey, and kindergarten direct assessments). In contrast, the sample for the main analysis presented in Chapter 3 uses the full amount of data available (for instance, all families who responded to the caregiver survey are used in the analysis of outcomes derived from the caregiver survey, regardless of whether they had participated in earlier MIHOPE follow-ups). The analysis is limited to 1,119 families. Estimated effects for these families are expected to differ from the estimated effects for all families, particularly if these 1,119 families significantly differ from families with any data from the kindergarten follow-up. Also, given that this sample of families is smaller than the main analysis sample, there is less power to detect statistically significant effects.

The results for families who responded to all survey waves are marginally different from the results of the main analysis. For 18 outcomes, the direction of the estimated effect changed. For 15 of these outcomes, the estimated effects when limiting the sample to families who responded to all survey waves are no longer favorable; however, all estimated effects are small and not statistically significant. For five outcomes, the estimated effect is statistically significant in the main analysis but is not statistically significant when limiting the sample to families who responded to all survey waves. Despite these differences, the results from the sensitivity check limiting the sample to families who responded to all survey waves yield largely similar findings to the main analysis findings. The differences between the two sets of results are small and spread across sub-areas, such that no one research question is more affected than the others.

Appendix Table G.17. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.97	23.81	0.16	0.05	0.522	-0.25	0.57
Perceived social support	19.65	18.86	0.79	0.16	0.018	0.24	1.34
Resource mobilization	15.42	15.43	-0.01	0.00	0.958	-0.48	0.45
Parenting distress							
Parenting distress	8.91	8.98	-0.08	-0.02	0.742	-0.46	0.31
Parent-child relationship							
Parental warmth	5.99	6.12	-0.13	-0.07	0.254	-0.32	0.06
Parent-child dysfunctional interaction	9.14	9.53	-0.39	-0.11	0.108	-0.80	0.01
Aggression toward child							
Frequency of psychological aggression during the past year	6.59	7.04	-0.45	-0.07	0.260	-1.12	0.21
Frequency of physical aggression during the past year (%)	3.44	4.12	-0.68	-0.03	0.575	-2.68	1.32
Behavior toward child during semi-structured task							
Parental sensitivity	4.72	4.74	-0.03	-0.03	0.681	-0.14	0.08
Parental positive regard	4.41	4.39	0.02	0.02	0.743	-0.08	0.12
Parental stimulation of cognitive development	4.44	4.44	0.00	0.00	0.947	-0.10	0.10
Parental intrusiveness	1.84	1.84	0.01	0.01	0.931	-0.10	0.11
Parental detachment	1.11	1.13	-0.02	-0.04	0.543	-0.06	0.03
Parental negative regard	1.14	1.15	-0.01	-0.03	0.628	-0.06	0.04
Parental support for learning and development							
Reads to child daily (%)	39.28	41.08	-1.79	-0.04	0.561	-6.88	3.29
Average amount of reading to child per day in a typical week (minutes)	21.00	21.56	-0.55	-0.03	0.564	-2.13	1.02
Number of children's books in the home	57.57	56.45	1.11	0.02	0.779	-5.41	7.63
Composite of in-home literacy activities	0.69	0.69	0.00	-0.01	0.853	-0.04	0.03
Composite of in-home learning activities	0.60	0.60	0.00	0.01	0.858	-0.03	0.03
Percentage of days absent from school	7.67	8.25	-0.57	-0.05	0.614	-2.46	1.31
Sample size (total = 1,119)	550	569					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.18. Estimated Effects on Maternal Mental and Behavioral Health at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Maternal coping strategies							
Mastery	23.97	23.81	0.16	0.05	0.522	-0.25	0.57
Perceived social support	19.65	18.86	0.79	0.16	0.018	0.24	1.34
Resource mobilization	15.42	15.43	-0.01	0.00	0.958	-0.48	0.45
Parenting distress							
Parenting distress	8.91	8.98	-0.08	-0.02	0.742	-0.46	0.31
Maternal depressive symptoms (%)							
Exhibits depressive symptoms	22.36	23.23	-0.87	-0.02	0.729	-5.00	3.26
Maternal substance use (%)							
Used illicit drugs	8.49	7.62	0.87	0.03	0.610	-1.94	3.68
Excessive drinking	17.03	15.36	1.67	0.05	0.464	-2.09	5.43
Sample size (total = 1,119)	550	569					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.19. Estimated Effects on Parent-Child Interactions at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Parent-child relationship							
Parental warmth	5.99	6.12	-0.13	-0.07	0.254	-0.32	0.06
Parent-child dysfunctional interaction	9.14	9.53	-0.39	-0.11	0.108	-0.80	0.01
Aggression toward child							
Frequency of psychological aggression during the past year	6.59	7.04	-0.45	-0.07	0.260	-1.12	0.21
Frequency of physical aggression during the past year (%)	3.44	4.12	-0.68	-0.03	0.575	-2.68	1.32
Behavior toward child during semi-structured task							
Parental sensitivity	4.72	4.74	-0.03	-0.03	0.681	-0.14	0.08
Parental positive regard	4.41	4.39	0.02	0.02	0.743	-0.08	0.12
Parental stimulation of cognitive development	4.44	4.44	0.00	0.00	0.947	-0.10	0.10
Parental intrusiveness	1.84	1.84	0.01	0.01	0.931	-0.10	0.11
Parental detachment	1.11	1.13	-0.02	-0.04	0.543	-0.06	0.03
Parental negative regard	1.14	1.15	-0.01	-0.03	0.628	-0.06	0.04
Behavior toward parent during semi-structured task							
Child engagement of parent	5.00	4.99	0.01	0.01	0.891	-0.10	0.12
Child negativity toward parent	1.26	1.26	0.00	-0.01	0.918	-0.08	0.07
Parental support for learning and development							
Reads to child daily (%)	39.28	41.08	-1.79	-0.04	0.561	-6.88	3.29
Average amount of reading to child per day in a typical week (minutes)	21.00	21.56	-0.55	-0.03	0.564	-2.13	1.02
Number of children's books in the home	57.57	56.45	1.11	0.02	0.779	-5.41	7.63
Composite of in-home literacy activities	0.69	0.69	0.00	-0.01	0.853	-0.04	0.03
Composite of in-home learning activities	0.60	0.60	0.00	0.01	0.858	-0.03	0.03
Percentage of days absent from school	7.67	8.25	-0.57	-0.05	0.614	-2.46	1.31
Sample size (total = 1,119)	550	569					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.20. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Family conflict							
Family conflict	1.59	1.63	-0.04	-0.08	0.306	-0.10	0.02
Intimate partner violence (%)							
Maternal experience with physical violence	3.17	5.31	-2.14	-0.09	0.104	-4.31	0.02
Maternal perpetration of physical violence	7.61	7.94	-0.33	-0.01	0.849	-3.16	2.50
Maternal experience with battering	2.40	3.71	-1.32	-0.07	0.235	-3.14	0.51
Aggression toward child							
Frequency of psychological aggression during the past year	6.59	7.04	-0.45	-0.07	0.260	-1.12	0.21
Frequency of physical aggression during the past year (%)	3.44	4.12	-0.68	-0.03	0.575	-2.68	1.32
Child maltreatment (%)							
Any substantiated report of abuse since 15 months	0.87	0.26	0.61	0.08	0.306	-0.37	1.59
Any substantiated report of neglect since 15 months	1.99	1.41	0.58	0.05	0.583	-1.16	2.33
Any hospitalizations for injuries or ingestions since 15 months	1.59	1.24	0.35	0.03	0.685	-1.06	1.76
Sample size (total = 1,119)	550	569					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.21. Estimated Effects on Economic Circumstances at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Education, employment, and income							
Increase in education level since study entry (%)	26.91	28.98	-2.07	-0.05	0.422	-6.30	2.17
Receipt of high school diploma since study entry (%)	46.73	48.01	-1.28	-0.03	0.824	-10.78	8.22
Household income in the past year (\$)	32,876.42	33,578.26	-701.84	-0.03	0.731	-4,077.50	2,673.82
Material hardship							
Food insecurity (%)	19.38	24.47	-5.10	-0.12	0.067	-9.68	-0.51
Number of material hardships in the past year	1.26	1.36	-0.10	-0.07	0.291	-0.25	0.05
Number of moves in past year	0.43	0.35	0.08	0.11	0.147	-0.01	0.17
Sample size (total = 1,119)	550	569					

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.22. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	17.45	17.52	-0.07	-0.02	0.752	-0.43	0.29
Behavior problems							
Externalizing behaviors	10.15	10.04	0.11	0.02	0.756	-0.47	0.69
Internalizing behaviors	5.27	5.33	-0.06	-0.02	0.804	-0.48	0.36
Emotional and behavioral self-regulation							
Emotional self-control	13.48	13.32	0.16	0.04	0.540	-0.27	0.60
Hyperactivity/inattention	7.99	7.95	0.05	0.01	0.854	-0.36	0.46
Attention/impulse control	2.58	2.57	0.01	0.02	0.707	-0.04	0.07
Behavior toward parent during semi-structured task							
Child engagement of parent	5.00	4.99	0.01	0.01	0.891	-0.10	0.12
Child negativity toward parent	1.26	1.26	0.00	-0.01	0.918	-0.08	0.07
Sample size (total = 1,119)	550	569					

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.23. Estimated Effects on Children's Social-Emotional Functioning in School Settings at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Social skills							
Engagement	15.73	16.13	-0.40	-0.10	0.260	-0.99	0.19
Cooperation	12.68	12.86	-0.18	-0.04	0.609	-0.76	0.40
Assertive social skills	3.39	3.36	0.03	0.02	0.783	-0.15	0.20
Behavior problems							
Externalizing behaviors	7.53	7.67	-0.14	-0.02	0.821	-1.16	0.88
Internalizing behaviors	3.55	3.80	-0.25	-0.07	0.390	-0.72	0.22
Emotional and behavioral self-regulation							
Emotional self-control	14.53	14.55	-0.03	-0.01	0.954	-0.78	0.73
Hyperactivity/inattention	7.02	6.91	0.10	0.02	0.810	-0.60	0.80
Task orientation	3.33	3.40	-0.08	-0.07	0.421	-0.23	0.08
Frustration tolerance	3.59	3.52	0.08	0.07	0.420	-0.08	0.24
Sample size (total = 1,119)	550	569					

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

Appendix Table G.24. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, for Families Who Responded to All Survey Waves

Outcome	Program Group	Control Group	Difference (Effect)	Effect Size	P-Value	90% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive skills							
Inhibitory control - percent correct on valid trials	0.93	0.95	-0.01	-0.10	0.208	-0.03	0.00
Cognitive flexibility - percent correct on valid trials	0.83	0.82	0.01	0.03	0.644	-0.02	0.03
Short-term memory	3.87	3.92	-0.05	-0.05	0.412	-0.14	0.05
Language development							
Vocabulary knowledge	462.39	463.42	-1.03	-0.06	0.294	-2.65	0.59
Mathematics development							
Early numeracy and math skills	425.83	426.93	-1.09	-0.04	0.518	-3.87	1.69
Sample size (total = 1,119)	550	569					

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: See Appendix A for descriptions of the outcome measures used.

Rounding may cause slight discrepancies in sums and differences.

The p-value indicates the likelihood that the estimated effect (or larger) would have been generated by an intervention with zero true effect.

The sample size in this table reflects the number of families who responded to the 15-month survey, 2.5-year survey, 3.5-year survey, and kindergarten caregiver survey and direct assessments. Some measures in the table may have smaller sample sizes due to item non-response.

APPENDIX

H

Subgroup Differences in Estimated Effects, by Evidence-Based Model

This appendix chapter presents an exploratory analysis examining whether there are differences in estimated effects among the four evidence-based models included in MIHOPE: Early Head Start—Home-based option (EHS), Healthy Families America (HFA), Nurse-Family Partnership (NFP), and Parents as Teachers (PAT).

A primary aim of MIHOPE is to understand the effects of home visiting services delivered by MIECHV-funded programs. The four models included in MIHOPE aim to improve a broad range of family and child outcomes, placing high priority on parenting, child maltreatment, child development, and family economic self-sufficiency. However, they differ somewhat in how much priority they give to supporting maternal mental and behavioral health and reducing intimate partner violence.¹ The models also take somewhat different approaches to achieve their goals—whether it be differences in the credentials of their home visitors or the amount of home visiting services received by families.² The goal of this analysis was to explore variation in outcomes across the models included in MIHOPE.

There are several limitations to this analysis. Because each model enrolled only part of the study sample, there is less statistical power to find statistically significant effects for any individual model than for the full study sample. In addition, the study has greater statistical power to detect statistically significant effects for models with higher study enrollment. Because more families were enrolled through local programs operating the Healthy Families America model than any other model, estimated effects for that model are the most precise. Likewise, because the fewest families were enrolled through Early Head Start, estimated effects for that model are the least precise. This means that even if the four evidence-based models had equal effects on family outcomes, results for Healthy Families America are the most likely to be statistically significant and results for Early Head Start are the least likely to be statistically significant.

In light of these limitations, this analysis first examined whether there was a possibility of bias for the samples represented by each model. Based on those results, the analysis then examined model differences in effects using the same subgroup approach used in Appendix F.

POTENTIAL FOR BIAS IN MODEL SUBGROUP ANALYSES

To determine the extent to which there was the potential for bias in the model subgroup analyses, the study team conducted tests about (1) the conceptual possibility of bias and (2) the potential for response bias in data collection responses.

The study team sought input from external advisors regarding the results of these checks for potential bias. Based collectively on the results of the bias checks and the available sample, the study team, in consultation with federal staff, decided to move forward with analyzing

1. Michalopoulos et al. (2015).

2. Duggan et al. (2018).

and presenting caregiver and in-home measures by model in this appendix chapter and decided to exclude teacher survey measures from this appendix chapter. The results of those tests are provided in detail below.

Conceptual Possibility of Bias

Differences in response rates between the program and control groups increase the possibility that findings are biased because the equivalence between the program and control groups created by the study's random assignment is not preserved. To assess this possibility for the model-specific findings, the study team compared response rates for each evidence-based model to standards proposed by the What Works Clearinghouse (WWC). Using overall response rate and the difference in response rates between program and control group members, the WWC names two categories of potential bias in their Version 5 standards: (1) high attrition, when the combination of overall and differential rates of attrition results in unacceptable levels of potential bias, and (2) low attrition, when the combination of overall and differential rates of attrition results in tolerable levels of potential bias.³

To assist in categorizing studies as low or high attrition, the WWC provides attrition boundaries using both optimistic and cautious assumptions.⁴ The study team used the optimistic boundaries to categorize attrition for the model-specific samples as low or high because the WWC indicates that the optimistic boundaries should be used if survey response is not related to the intervention, and there is no conceptual reason to believe that being randomly assigned to a home visiting program would affect the availability of follow-up data.

Potential for Response Bias in Data Collection Responses

In addition to examining response rates, data from the MIHOPE baseline survey were used to provide information on the likelihood of bias. Specifically, for each model and each of the data sources (caregiver survey, in-home assessments, and teacher survey), the study team compared characteristics at study entry for program group respondents to characteristics at study entry for control group respondents. Analyses were conducted to determine if, at study entry, program group respondents to the kindergarten data sources were significantly different from control group respondents to the kindergarten data sources, since that could lead to biased findings.

Caregiver Survey Potential for Bias

For the caregiver survey, the results of the two bias checks do not suggest potential for bias for any of the four models. Based on the overall and differential attrition shown in Appendix Table H.1, all models meet the WWC standards for low attrition, and no models had statistically significant differences between program and control group respondents on baseline characteristics.

3. What Works Clearinghouse (2022).

4. For more information on the development of the attrition standards, see Deke and Chiang (2017).

Appendix Table H.1. Conceptual Possibility of Bias in Estimated Effects by Evidence-Based Model for Outcomes Created from the Caregiver Survey

Measure	EHS	HFA	NFP	PAT
Respondent sample	371	853	663	555
Response rate (%)				
Overall	65.66	59.53	56.67	59.42
Program group	63.80	59.32	58.09	58.46
Control group	67.48	59.72	55.23	60.39
Attrition rate (%)				
Overall	34.34	40.47	43.33	40.58
Differential	3.68	0.40	2.86	1.93
WWC attrition category	Low	Low	Low	Low
P-value of joint test of program-control group differences in baseline characteristics	0.138	0.954	0.945	0.782

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTE: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers, WWC = What Works Clearinghouse.

In-Home Data Collection Potential for Bias

For the in-home data collection, the results of the two bias checks do not suggest potential for bias in the results for three models (HFA, NFP, and PAT) and suggest some potential for bias in the results for the EHS model. Based on the overall and differential attrition shown in Appendix Table H.2, all models meet the WWC standards for low attrition. However, statistical tests of differences between the program and control group respondents showed that there was a statistically significant difference on baseline characteristics for EHS ($p = 0.053$) but not for the other three evidence-based models.

Teacher Survey Potential for Bias

For the teacher survey, the results of the two bias checks suggest some potential for bias in the results of all four models. Based on the overall and differential attrition shown in Appendix Table H.3, EHS meets the WWC standards for low attrition, and the other three models do not. The statistical tests of differences between the program and control group respondents showed that there was a statistically significant difference on baseline characteristics for EHS ($p = 0.077$) but not for the other three evidence-based models.

Appendix Table H.2. Conceptual Possibility of Bias in Estimated Effects by Evidence-Based Model for Outcomes Created from Direct Assessments

Measure	EHS	HFA	NFP	PAT
Respondent sample	353	805	631	543
Response rate (%)				
Overall	62.48	56.18	53.93	58.14
Program group	62.01	55.37	54.00	56.75
Control group	62.94	56.97	53.86	59.53
Attrition rate (%)				
Overall	37.52	43.82	46.07	41.86
Differential	0.93	1.60	0.14	2.78
WWC attrition category	Low	Low	Low	Low
P-value of joint test of program-control group differences in baseline characteristics	0.053	0.882	0.944	0.767

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTE: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Paren

Appendix Table H.3. Conceptual Possibility of Bias in Estimated Effects by Evidence-Based Model for Outcomes Created from the Teacher Survey

Measure	EHS	HFA	NFP	PAT
Respondent sample	222	462	330	303
Response rate (%)				
Overall	39.29	32.24	28.21	32.44
Program group	39.78	31.64	31.69	30.41
Control group	38.81	32.83	24.70	34.48
Attrition rate (%)				
Overall	60.71	67.76	71.79	67.56
Differential	0.97	1.19	6.99	4.07
WWC attrition category	Low	High	High	High
P-value of joint test of program-control group differences in baseline characteristics	0.077	0.610	0.321	0.203

SOURCE: Calculations based on the MIHOPE kindergarten teacher survey.

NOTE: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers, WWC = What Works Clearinghouse.

SUBGROUP ANALYSIS OF EVIDENCE-BASED MODEL DIFFERENCES

Similar to the subgroup analysis by family characteristics in Appendix F, this evidence-based model subgroup analysis follows the same organizational framework used in the main kindergarten analysis, examining groups of outcomes organized under the pre-specified research questions. As in Appendix F, omnibus tests were not conducted. Outcomes that contribute to seven of the eight research questions are included in this analysis. Because teacher survey measures are excluded from this analysis as described above, the research question related to children’s social-emotional functioning in school settings was not examined.

The evidence-based model subgroup analysis examined whether the estimated effects on individual outcomes (grouped by research question) differed among the models. To do so, the analysis first split the sample by each of the four models and effects for each individual outcome in each research question were estimated. Appendix Tables H.4 through H.10 show the control group levels and estimated effects for each outcome.

The analysis then examined if there were statistically significant differences in the estimated effects for each individual outcome among the EHS, HFA, NFP, and PAT samples—referred to here as an “across-group” analysis. The p-value of that statistical test is shown in the last column of each table. The p-value indicates the probability of finding differences in effects at least as large as those shown in the table if there were no true differences across the evidence-based models.

The tables also show the results of what is referred to here as a “within-group analysis.” This analysis examines whether there are statistically significant effects within any specific model, for example, whether there are differences between families who were randomly assigned to receive services from PAT versus not. The asterisks in the tables represent the p-value of the statistical test assessing whether home visiting had effects that were statistically significant within that model. However, because each model enrolled only part of the study sample, there is less statistical power to find statistically significant effects for any individual model than for the full study sample. In addition, because more families were enrolled for some models than for others, a statistically significant within-group finding in one evidence-based model but not the other could be driven by issues with precision and not having enough power to detect effects due to sample sizes for that evidence-based model. Finally, as described above, it is the p-value of the across-group statistical test that provides information about whether the effects of home visiting differ across evidence-based models. When interpreting the results, the study team only examined within-group findings if the results of the across-group tests are statistically significant, while simultaneously recognizing that differences in sample sizes across models could contribute to whether statistically significant effects within model were present.

Appendix Table H.4. Estimated Effects on Kindergarten Maternal Coping Strategies and Parenting Behaviors Resulting from Direct Interaction Between Parents and Home Visitors, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Maternal coping strategies									
Mastery	23.87	0.04	23.74	0.14	23.64	0.54 *	23.78	-0.04	0.579
Perceived social support	19.47	-0.44	18.80	0.83 **	19.04	0.87 *	18.53	0.90 *	0.286
Resource mobilization	15.85	-0.44	15.26	-0.06	15.16	0.29	14.99	0.20	0.654
Parenting distress									
Parenting distress	8.87	-0.23	8.90	-0.06	9.25	-0.50	8.69	0.48	0.184
Parent-child relationship									
Parental warmth	6.24	-0.24	5.99	-0.04	6.05	-0.14	5.83	0.11	0.562
Parent-child dysfunctional interaction	9.72	-0.65	9.44	-0.31	9.82	-0.92 ***	9.45	0.25	0.098
Aggression toward child									
Frequency of psychological aggression during the past year	7.19	-0.68	6.72	-0.60	6.52	-0.94 *	6.20	0.88	0.086
Frequency of physical aggression during the past year (%)	4.22	-1.80	4.19	-0.17	3.87	-0.53	1.67	0.86	0.727
Behavior toward child during semi-structured task									
Parental sensitivity	4.81	-0.19	4.56	0.05	4.59	0.11	4.58	0.21 **	0.076
Parental positive regard	4.44	-0.13	4.38	0.00	4.36	0.10	4.31	0.14	0.237
Parental stimulation of cognitive development	4.44	-0.12	4.31	0.00	4.31	0.04	4.35	0.20 **	0.134
Parental intrusiveness	1.70	0.08	1.90	0.06	1.82	-0.07	2.04	-0.21 **	0.083
Parental detachment	1.11	0.00	1.14	-0.02	1.15	-0.06	1.14	-0.04	0.771
Parental negative regard	1.18	0.01	1.18	0.04	1.15	-0.03	1.23	-0.11 **	0.157

(continued)

Appendix Table H.4 (continued)

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Parental support for learning and development									
Reads to child daily (%)	41.29	-8.28	39.73	-2.09	36.58	6.59 *	40.89	-3.05	0.131
Average amount of reading to child per day in a typical week (minutes)	22.41	-2.01	21.96	-1.07	21.95	0.11	22.09	-0.79	0.770
Number of children's books in the home	52.18	3.33	44.78	8.83 **	39.85	2.09	58.35	-1.00	0.420
Composite of in-home literacy activities	0.73	-0.07 *	0.68	0.00	0.67	0.05 *	0.68	0.00	0.064
Composite of in-home learning activities	0.63	-0.03	0.59	0.02	0.62	0.02	0.59	0.01	0.621
Percentage of days absent from school	12.01	2.75	7.89	0.39	7.79	-0.20	7.62	0.59	0.880
Sample size (total = 4,102)	286		725		583		467		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

**Appendix Table H.5. Estimated Effects on Maternal Mental and Behavioral Health
at Kindergarten, by Evidence-Based Model**

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Maternal coping strategies									
Mastery	23.87	0.04	23.74	0.14	23.64	0.54 *	23.78	-0.04	0.579
Perceived social support	19.47	-0.44	18.80	0.83 **	19.04	0.87 *	18.53	0.90 *	0.286
Resource mobilization	15.85	-0.44	15.26	-0.06	15.16	0.29	14.99	0.20	0.654
Parenting distress									
Parenting distress	8.87	-0.23	8.90	-0.06	9.25	-0.50	8.69	0.48	0.184
Maternal depressive symptoms (%)									
Exhibits depressive symptoms	26.64	-0.94	21.71	0.63	24.30	-1.99	21.06	1.95	0.858
Maternal substance use (%)									
Used illicit drugs	11.33	-1.43	7.06	-1.91	8.05	-1.48	7.65	1.05	0.787
Excessive drinking	19.87	-7.88 *	16.96	2.67	20.11	-1.20	15.28	2.98	0.141
Sample size (total = 4,102)	286		725		583		467		

SOURCE: Calculations based on the MIHOPE kindergarten caregiver survey.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table H.6. Estimated Effects on Parent-Child Interactions at Kindergarten, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Parent-child relationship									
Parental warmth	6.24	-0.24	5.99	-0.04	6.05	-0.14	5.83	0.11	0.562
Parent-child dysfunctional interaction	9.72	-0.65	9.44	-0.31	9.82	-0.92 ***	9.45	0.25	0.098
Aggression toward child									
Frequency of psychological aggression during the past year	7.19	-0.68	6.72	-0.60	6.52	-0.94 *	6.20	0.88	0.086
Frequency of physical aggression during the past year (%)	4.22	-1.80	4.19	-0.17	3.87	-0.53	1.67	0.86	0.727
Behavior toward child during semi-structured task									
Parental sensitivity	4.81	-0.19	4.56	0.05	4.59	0.11	4.58	0.21 **	0.076
Parental positive regard	4.44	-0.13	4.38	0.00	4.36	0.10	4.31	0.14	0.237
Parental stimulation of cognitive development	4.44	-0.12	4.31	0.00	4.31	0.04	4.35	0.20 **	0.134
Parental intrusiveness	1.70	0.08	1.90	0.06	1.82	-0.07	2.04	-0.21 **	0.083
Parental detachment	1.11	0.00	1.14	-0.02	1.15	-0.06	1.14	-0.04	0.771
Parental negative regard	1.18	0.01	1.18	0.04	1.15	-0.03	1.23	-0.11 **	0.157
Behavior toward parent during semi-structured task									
Child engagement of parent	4.95	0.12	5.07	-0.18 **	5.05	0.11	4.93	0.12	0.019
Child negativity toward parent	1.22	0.01	1.28	-0.01	1.26	-0.01	1.31	-0.06	0.842

(continued)

Appendix Table H.6 (continued)

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Parental support for learning and development									
Reads to child daily (%)	41.29	-8.28	39.73	-2.09	36.58	6.59 *	40.89	-3.05	0.131
Average amount of reading to child per day in a typical week (minutes)	22.41	-2.01	21.96	-1.07	21.95	0.11	22.09	-0.79	0.770
Number of children's books in the home	52.18	3.33	44.78	8.83 **	39.85	2.09	58.35	-1.00	0.420
Composite of in-home literacy activities	0.73	-0.07 *	0.68	0.00	0.67	0.05 *	0.68	0.00	0.064
Composite of in-home learning activities	0.63	-0.03	0.59	0.02	0.62	0.02	0.59	0.01	0.621
Percentage of days absent from school	12.01	2.75	7.89	0.39	7.79	-0.20	7.62	0.59	0.880
Sample size (total = 4,102)	286		725		583		467		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, the parent-child video-recorded interaction, and school records.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table H.7. Estimated Effects on Family Conflict, Intimate Partner Violence, Aggression, and Child Maltreatment at Kindergarten, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Family conflict									
Family conflict	1.64	0.02	1.60	0.00	1.58	-0.07 *	1.65	-0.05	0.540
Intimate partner violence (%)									
Maternal experience with physical violence	5.32	-2.29	4.10	-0.87	2.76	0.23	5.13	-1.94	0.723
Maternal perpetration of physical violence	9.45	-4.45	7.79	-0.12	5.86	3.49	7.42	0.76	0.210
Maternal experience with battering	3.39	-1.20	3.36	-0.78	2.87	-1.83	5.69	-2.69	0.829
Aggression toward child									
Frequency of psychological aggression during the past year	7.19	-0.68	6.72	-0.60	6.52	-0.94 *	6.20	0.88	0.086
Frequency of physical aggression during the past year (%)	4.22	-1.80	4.19	-0.17	3.87	-0.53	1.67	0.86	0.727
Child maltreatment (%)									
Any substantiated report of abuse since 15 months	1.05	0.82	0.92	-0.60	0.69	-0.15	0.47	-0.11	0.792
Any substantiated report of neglect since 15 months	3.28	1.04	2.50	1.44	2.74	-0.51	1.08	-0.77	0.414
Any hospitalizations for injuries or ingestions since 15 months	1.86	-0.70	3.58	-0.06	0.66	-0.08	2.64	-0.14	0.985
Sample size (total = 4,102)	286		725		583		467		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, state administrative child welfare records, and Medicaid claims records.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table H.8. Estimated Effects on Economic Circumstances at Kindergarten, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Education, employment, and income									
Increase in education level since study entry (%)	25.52	0.82	28.42	-0.50	37.31	-3.62	29.66	-1.68	0.870
Receipt of high school diploma since study entry (%)	33.64	26.99 *	43.83	-1.14	66.24	-8.92	43.06	2.65	0.132
Quarters employed in past year	2.40	0.01	2.41	0.04	2.48	0.19 *	2.26	0.19	0.601
Average quarterly earnings in the past year (\$)	3,515.12	-21.81	3,316.59	90.73	3,852.36	421.10	3,090.40	370.92	0.685
Household income in the past year (\$)	29,867.01	1,204.73	28,925.59	2,266.59	32,724.61	-57.60	34,872.88	-3,723.32	0.501
Material hardship									
Food insecurity (%)	25.14	-2.76	25.27	-3.47	21.89	-7.73 **	23.55	-0.68	0.602
Number of material hardships in the past year	1.59	-0.18	1.44	-0.06	1.32	-0.23 *	1.43	0.07	0.356
Number of moves in past year	0.51	-0.01	0.39	0.04	0.40	0.04	0.45	-0.01	0.941
Sample size (total = 4,102)	286		725		583		467		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey and National Directory of New Hires records.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table H.9. Estimated Effects on Children's Social-Emotional Functioning in the Home Context at Kindergarten, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Social skills - home context									
Engagement	16.84	0.94 **	17.53	-0.07	17.50	0.21	17.27	-0.02	0.202
Behavior problems - home context									
Externalizing behaviors	10.59	-0.85	10.28	-0.24	9.90	-0.68	10.21	0.32	0.393
Internalizing behaviors	5.59	-0.81 *	5.43	-0.47 *	5.32	-0.37	5.14	0.23	0.300
Emotional and behavioral self-regulation - home context									
Emotional self-control	12.47	1.06 **	13.33	0.04	13.24	0.38	13.23	-0.11	0.217
Hyperactivity/inattention	8.15	-0.67	8.38	-0.44	8.13	-0.56 *	7.91	0.34	0.192
Attention/impulse control	2.53	0.05	2.54	0.02	2.58	0.06	2.52	0.04	0.914
Behavior toward parent during semi-structured task									
Child engagement of parent	4.95	0.12	5.07	-0.18 **	5.05	0.11	4.93	0.12	0.019
Child negativity toward parent	1.22	0.01	1.28	-0.01	1.26	-0.01	1.31	-0.06	0.842
Sample size (total = 4,102)	286		725		583		467		

SOURCES: Calculations based on the MIHOPE kindergarten caregiver survey, field interviewer ratings during direct assessment, and the parent-child video-recorded interaction.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

Appendix Table H.10. Estimated Effects on Children's Cognitive, Language, and Early Math Skills at Kindergarten, by Evidence-Based Model

Outcome	EHS		HFA		NFP		PAT		P-Value
	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	Control Group	Difference (Effect)	
Cognitive skills									
Inhibitory control - percent correct on valid trials	0.92	0.01	0.94	-0.01	0.95	-0.01	0.94	-0.01	0.953
Cognitive flexibility - percent correct on valid trials	0.81	0.02	0.79	0.02	0.80	0.01	0.80	0.05 ***	0.381
Short-term memory	3.91	0.03	3.89	0.08	3.88	-0.07	3.92	0.08	0.412
Language development									
Vocabulary knowledge	464.15	1.94	462.64	-1.25	461.98	-0.94	463.81	0.29	0.329
Mathematics development									
Early numeracy and math skills	425.37	2.57	424.92	0.68	425.44	1.12	426.29	2.42	0.909
Sample size (total = 4,102)	286		725		583		467		

SOURCE: Calculations based on the MIHOPE kindergarten direct child assessments.

NOTES: EHS = Early Head Start—Home-based option, HFA = Healthy Families America, NFP = Nurse-Family Partnership, PAT = Parents as Teachers.

See Appendix A for descriptions of the outcome measures used.

Statistical significance levels for differences within subgroups are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

Subgroup difference p-value was calculated with an omnibus test (HT statistic) that tests whether the effects are different across all groups to a statistically significant degree.

The maximum sample size has been displayed; however, sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source.

FINDINGS

The results of this analysis do not find indication that there are differences in estimated effects among the four evidence-based models in MIHOPE. Of the 51 tests conducted, six outcomes (12 percent) showed a statistically significant difference in effects for groups of families when split by their evidence-based model.⁵ Because the percentage of outcomes with significant differences was slightly higher than ten percent, the study team reviewed the results for these six outcomes to determine whether there was a pattern of effects to interpret *within* a particular model, while simultaneously recognizing that differences in sample sizes across models could contribute to whether statistically significant effects within model were present.

Those six outcomes contribute to four research questions related to (1) maternal coping strategies and parenting behaviors resulting from direct interaction between parents and home visitors (five differences out of 20 tests); (2) parent-child interactions (six differences out of 18 tests); (3) family conflict, intimate partner violence, aggression, and child maltreatment (one difference out of 9 tests); and (4) children's social-emotional functioning in the home context (one difference out of 8 tests).⁶

For the small number of outcomes with effects that are statistically significantly different across models, the results do not suggest that effects are systematically more or less favorable for any of the evidence-based models. Again, the study team only interpreted within-group effects when there is an across-group statistically significant finding, and even then, proceeded cautiously because the power to detect effects varied for each evidence-based model. Further, after an adjustment for conducting multiple tests was applied across all 51 comparisons, no statistically significant differences in estimated effects remained.⁷

Taken together, these results point to home visiting programs having similar effects on a broad range of family and child outcomes.

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5. As noted in Chapter 2, some sub-areas contribute to more than one research question, so some of these statistically significant differences appear in more than one research question. The research question related to children's social-emotional functioning in school settings was not examined in this analysis due to some potential for bias in all four models (see Appendix Table H.3).
 6. Additionally, three research questions did not have any significant differences in effects by evidence-based model: (1) maternal mental and behavioral health; (2) economic circumstances; and (3) children's cognitive, language, and early math skills.
 7. The adjustment used was the Benjamini-Hochberg adjustment. See Benjamini and Hochberg (1995).

APPENDIX

I

Virtual Adaptation to Data Collection Protocol

This appendix chapter describes the adaptations made to the kindergarten follow-up's data collection effort to preserve the overall design of the study within the context of the COVID-19 pandemic. Specifically, the data collection effort for Cohorts 3 and 4 was fielded completely virtually, leveraging recent advancements in virtual assessment efforts. A summary of the pilot efforts to assess the feasibility of the endeavor and the adaptations made to the protocol are described below.

PILOTING THE FEASIBILITY OF AN ALL-VIRTUAL ASSESSMENT

As the study team began preparing to resume data collection during the 2021-2022 school year, concerns remained about conducting a large-scale in-person data collection effort, which would require air travel and in-person contact in families' homes. The study team hypothesized that many children in the Cohort 3 sample had experienced remote schooling via a virtual platform during kindergarten because of the widespread use of remote or virtual schooling during the 2020-2021 school year and that working in a virtual setting was not something completely unfamiliar to these families. Given that working in a virtual setting seemed promising and because of the risk to both families in MIHOPE and the data collection staff, the study team conducted a pilot in the summer of 2021 to determine the feasibility of supplying necessary technology and conducting an all-virtual version of the in-home assessment portion of the data collection which was conducted with children and their mothers. The pilot was conducted across two rounds with a total of 26 families,¹ which enabled the study team to refine the protocols for the virtual assessment battery, delivery of technology into families' homes, improving connectivity to the internet, and ensuring proper device set-up before starting the virtual visit and connecting to remote field interviewers (more details provided in the next section). The study team also provided more powerful devices to minimize any possible lag in presentation of stimuli or data recording during the virtual visit. Preliminary analysis of pilot data resulted in comparable scores with those scores obtained from in-person data collection with Cohorts 1 and 2, and the study team determined that it was possible to conduct the remainder of data collection in a virtual modality.

Following the completion of the pilot, the study team decided to move forward with conducting all in-home assessments virtually for Cohorts 3 and 4. Discussion of findings that split the sample based on when the children were assessed (pre-pandemic versus pandemic samples) is found in Chapters 3 and 4.

1. These families were recruited separately for the pilot study and were not part of the MIHOPE sample.

ADAPTATIONS FOR ALL-VIRTUAL DATA COLLECTION

Although assessments in Cohorts 1 and 2 were conducted by a trained assessor in families' homes, the assessment protocol used for these cohorts was already programmed on a device to include all instructions to the assessor, item prompts to be read, and fields to record the child's responses. In addition, a device was already being used to present stimuli pictures to the child for the Woodcock-Johnson III Applied Problems, Woodcock-Johnson IV Picture Vocabulary, and *preLAS* Art Show. The study team expanded the existing protocol to ensure that the assessments could be conducted without an assessor entering families' homes. The adaptations were informed by existing guidance from developers of two of the instruments used in the in-home assessment—the *preLAS* and the Woodcock-Johnson—on how to adapt those instruments to a virtual setting.² Early evidence demonstrated that it was possible to conduct tasks like the Woodcock-Johnson IV Cognitive and Achievement Tests in a virtual manner.³

The study team created an assessment protocol that involved delivering all the necessary technological hardware to the family in advance of the virtual assessment and used video conferencing and screen sharing technology to facilitate the virtual assessment. (This included supplying MiFi mobile wireless hotspots to families for situations in which there was no reliable wireless connection.) In adapting the in-home assessment to a virtual format, the goal of the study team was to preserve consistency across the two modalities (in-person and virtual) as much as possible. With permission from instrument developers, adaptations for the virtual assessment included:

- *Item-level changes to validated instruments.* Due to the limited view of the child on the computer screen, some items on the *preLAS* Simon Says task were changed so the assessor would be able to view the child's movements and accurately score their responses. For example, "Simon says put your feet together" was changed to "Simon says put your hands together."
- *Technological adaptations for child responses.* As some assessment items required the child to point to a picture to respond, the children were shown early on in the battery how to use the annotate feature on WebEx to draw a line through the picture on the touch-

2. Riverside Insights granted written permission to use the two subtests from the Woodcock-Johnson virtually. The study team referred to Riverside Insights (n.d.) for how to adapt the Woodcock-Johnson for virtual administration. In accordance with the study's licensing agreement with Data Recognition Corporation (DRC), the following disclaimer is provided: "DRC granted permission to use two subtests of DRC's proprietary *preLAS* 2000 product for use in this research study. DRC strongly recommends the use of *preLAS* according to product guidelines in order to preserve the integrity of test interpretation. DRC is not responsible for the design, methodology or findings of this study. Use of the DRC proprietary materials in any way that does not conform to product guidelines, including score interpretation, is not the responsibility of DRC." The study team adapted the two subtests from the *preLAS* in line with product guidelines for remote testing following specifications in Data Recognition Corporation (2022).

3. Wright (2018).

screen to provide a response. The assessor checked the child's comprehension and involved the caregiver to facilitate, when necessary.

- *Task protocol edits.* Because slow internet connectivity could present administration challenges to the virtual assessment, the study team programmed additional Digit Span items to be used in the event that a technological challenge prevented the child from having an item properly administered. This was important as Digit Span items cannot be repeated. Script changes were also implemented to the Three-Bags Task to account for the reliance on the caregiver to set up the task materials on their own and to make the set-up sequence more efficient.
- *Motivating activity.* Since children could no longer receive stickers from the assessor to motivate them through the battery of tasks, the study team developed an interactive “build-a-monster” game in which the child selected different body parts after each task to complete and animate a monster image at the end of the assessment battery.
- *Post-task checkpoints.* Assessors provided additional data after each task to flag whether anything occurred that could impact the quality of the data (e.g., caregiver unavailable; problem with technology, such as the internet connection, software problem, screen share/display; caregiver helping child by providing or influencing responses; household interruption; active or passive refusal).

The data collection protocol largely stayed the same for the caregiver survey, with some additional items included to ask caregivers about their children's experiences in the 2020-2021 school year, to understand whether children received any in-person instruction. The teacher survey was also adapted to ask about the child's school experiences with distance learning if the child primarily attended remote/virtual class in the 2021-2022 school year.

APPENDIX

J

Mediation Analyses

In addition to the impact estimates presented in this report, the MIHOPE design also makes it possible to examine the possible mechanisms that might explain *how* home visiting had those effects. Drawing on data collected at earlier follow-up waves, when children were 15 months, 2.5 years, and 3.5 years old, this appendix chapter addresses the following research question:

1. What are the potential mechanisms through which home visiting may have had effects on select individual outcomes at the kindergarten follow-up?¹

Randomly assigning families to the program and control groups resulted in reliable, causal estimates of the effects that home visiting had on family outcomes at kindergarten. However, the results presented in this appendix do not necessarily reflect causal relationships.² For example, a finding that parent support for language and literacy at 15 months mediated the impact on cognitive flexibility at kindergarten does not necessarily mean that support for language and literacy was the *cause* of this impact. Rather, mothers who exhibit support for language and literacy may support their child's development in other ways that resulted in the impact on cognitive flexibility, such as supporting their cognitive development through the home math environment or enrolling them in a preschool program with a high-quality environment that nurtured the development of children's executive functioning skills (these environments were not measured in MIHOPE).

In contrast to the examination of overall patterns on groups of outcomes featured in the report, the mediation analyses presented in this appendix focus on three individual outcomes from the kindergarten follow-up: cognitive flexibility, parent-child dysfunctional interaction, and food insecurity. These outcomes were chosen from the nine individual outcomes that were statistically significantly impacted by home visiting at the kindergarten follow-up.³ Prior to conducting the main kindergarten impact analysis, two outcome areas were pre-specified as priority outcome areas to include in mediation analysis: child functioning and parent-child interactions. These three outcomes represent those two outcome areas as well as the economic self-sufficiency outcome area. They were chosen because they spotlight

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1. The mediation analysis had also planned to answer a second research question: Is there a sequence of outcomes through which home visiting had effects on families over time? However, this research question was relevant only if certain criteria were met in the primary models. Specifically, it was pre-specified that this analysis would only be conducted if a mediator from the 2.5-year or 3.5-year follow-up had a statistically significant indirect effect. This is because the sequential estimates can be thought of as a partitioning of an indirect effect into the part that is explained by other mediators in the model that come before it in the sequence and the part that is specific to the mediator of interest. Since no mediators from the 2.5-year or 3.5-year follow-up had a statistically significant indirect effect, this question was not pursued.
 2. Judd and Kenny (1981).
 3. The nine outcomes are: perceived social support, parent-child dysfunctional interaction, number of children's books in the home, cognitive flexibility, maternal experience with battering, quarters employed in the past year, average quarterly earnings in the past year, food insecurity, and number of material hardships in the past year.

varied and complementary aspects of child and family functioning, and taken together, also show a range of outcome areas that home visiting programs aim to affect.⁴

All outcomes that were statistically significantly impacted by home visiting at earlier waves of MIHOPE (15 months, 2.5 years, or 3.5 years) were considered as potential mediators. Several pieces of information were used to determine whether these potential mediators should be used as mediators for a particular kindergarten outcome, including the following: whether the variable could account for a sustained impact from earlier waves of MIHOPE, logic models from the four evidence-based home visiting models included in MIHOPE, theoretical frameworks from a range of social science disciplines, and prior empirical evidence. All mediators with a similarly strong rationale for inclusion were modeled for each outcome.

This appendix begins with a high-level summary of the mediation findings. Next, the findings for each of the three outcomes are discussed in turn. The appendix concludes with additional details about outcome and mediator selection in the section “Outcome and Mediator Selection” and analytic details in the section “Analytic Details and Additional Analysis.”

SUMMARY OF FINDINGS

Overall, there is little evidence that impacts found in earlier waves of MIHOPE explain the impacts on cognitive flexibility, parent-child dysfunctional interaction, and food insecurity at kindergarten. However, there was evidence of mediation for one of the mediators. The impact of home visiting on parent-child dysfunctional interaction at 15 months explained approximately 30 percent of the effect of home visiting on the same outcome at kindergarten. This means that reducing this type of parenting stress early in a child’s life may lead to continued reductions in dysfunctional interactions over time.

MEDIATION RESULTS

The mediation analysis used path analysis as the primary methodology for examining mechanisms that might explain the kindergarten results. Path analysis is an extension of linear regression that allows the simultaneous modeling of complex associations among variables.⁵ Pathways were modeled from random assignment to each of the mediators of interest, and from each of the mediators to the kindergarten outcome, controlling for a set of

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4. Outcome selection criteria considered both the breadth of outcome domains represented and the strength of the rationale for each outcome (the relative strength of the rationale for the proposed mediators for a particular outcome, the program or policy relevance of the specific outcome, and the effect sizes of the impacts on each outcome).
 5. Streiner (2005).

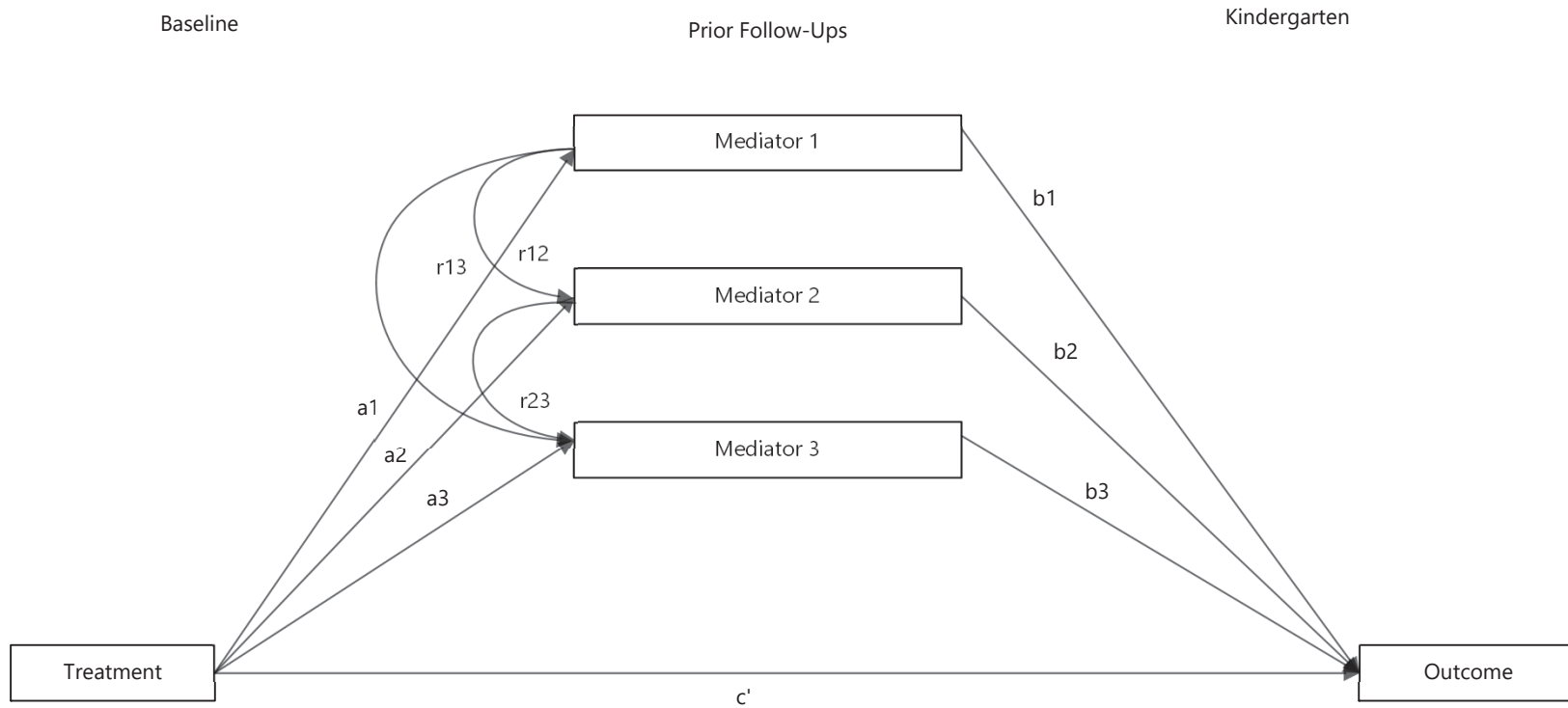
baseline covariates.⁶ Appendix Figure J.1 shows an example of the structure of this model. Estimating these pathways makes it possible to decompose the impact estimate (called the “total effect”) into two parts: the “indirect effect” that can be explained by each mediator (controlling for the others) and the “direct effect” that represents all other possible mediators or explanations (that is not explained by the mediators in the model). To ease interpretation of findings, the indirect effects are divided by the total effect to express the magnitude of the indirect effect in terms of the *percentage* of the impact that is explained by the mediator.

Then, secondary analyses and sensitivity tests were conducted to determine how sensitive the findings are to the chosen analytic approach and the variables included in the models.

- **Sensitivity to estimation approach:** The secondary analysis used a methodology called causal mediation analysis as a secondary estimation approach. Although the word “causal” is in the name of this approach, the results of this analysis also do not necessarily reflect causal relationships and should be interpreted with the same amount of caution as the results from the path analysis. Both path analysis and causal mediation analysis use linear models to calculate indirect effects for continuous mediators and outcomes but use different estimation approaches for binary mediators and outcomes. Thus, this analysis is used as an alternative strategy for estimating indirect effects for binary mediators and outcomes.
- **Sensitivity to omitted variables bias:** The sensitivity tests assessed the degree to which the results of the mediation analysis may be sensitive to the variables that were included in the models. Specifically, omitting confounders from the model may lead to false positives in the mediation findings. Therefore, these tests were conducted only for mediators with statistically significant indirect effects. Analyses were conducted to examine two types of confounders that may have biased these findings: measured confounders that were collected in MIHOPE after random assignment, but were not included in the mediation models, and unmeasured confounders that were not collected by the study.

6. Each equation—including the equation predicting the outcome and the equations predicting each mediator—included the same set of baseline covariates, which were a subset of those included in the primary impact analysis. All models included the evidence-based home visiting model implemented at the mother’s random assignment site, maternal age at baseline, maternal race/ethnicity, maternal education at baseline, maternal relationship status at baseline, maternal employment at baseline and child age at baseline. The cognitive flexibility and parent-child dysfunctional interaction models also controlled for child sex. In addition, models controlled for baseline measures of the mediators and outcome, if available. Specifically, the parent-child dysfunctional interaction model also included food insecurity at baseline, mastery at baseline, maternal mental health at baseline, experience with physical or sexual violence or battering at baseline, and SNAP receipt at baseline. The food insecurity model also included food insecurity at baseline, mastery at baseline, maternal mental health at baseline, experience with physical or sexual violence or battering at baseline, SNAP receipt at baseline, WIC receipt at baseline, maternal health status at baseline, and maternal health insurance coverage at baseline. The mediators and outcome in the cognitive flexibility outcome were not collected at baseline, so no additional covariates were used.

Figure J.1. Example Mediation Model



NOTES: Straight lines represent regression coefficients; curved lines represent correlations between variables. Although not shown in the figure, all models also control for baseline covariates, which were controlled in each regression equation. Indirect effects are calculated by multiplying the pathway from treatment to a mediator by the pathway from a mediator to the outcome (for example, the indirect effect for mediator 1 is calculated as $a_1 \cdot b_1$).

Analytic details for the primary models, secondary analysis, and sensitivity tests are described at the end of this appendix, in the section “Analytic Details and Additional Analyses.”

The next sections present the results of the mediation analyses. Results are described for each of the three outcomes: cognitive flexibility, parent-child dysfunctional interaction, and food insecurity. For each model, the mediators are described, and then results from the mediation analysis are presented.

MODEL 1: COGNITIVE FLEXIBILITY

Supporting parents’ knowledge about early childhood child development and developmentally appropriate parenting practices is an emphasis of the four home visiting models included in MIHOPE.⁷ Based on the evidence-based home visiting models’ logic models, there is an assumption that positive parenting practices will result in improved child outcomes that continue to persist as children transition into kindergarten. As mentioned earlier in this report, the transition to formal schooling is a sensitive period for children’s development.⁸ Children’s transition to formal schooling is supported by their executive functions. Executive functions are an interrelated set of cognitive skills, which include working memory, inhibitory control, and cognitive flexibility. These skills are associated with children’s outcomes in many different domains, including emotion regulation, attention, school engagement, language and literacy skills, and math skills.⁹ Cognitive flexibility, a sub-component of executive functions, is the only statistically significant individual outcome at kindergarten in the child functioning outcome area, which was pre-specified as a priority outcome area to include in the mediation analysis. The mediation analysis permits an examination of some of the mechanisms by which participation in home visiting services in early childhood may be related to children’s cognitive flexibility at the transition to formal schooling.

The mediators selected for the cognitive flexibility model were:

- **Economic circumstances**
 - **Increase in maternal education at 2.5 years:** An increase in maternal education since baseline indicates whether the mother increased her highest level of education since the time she entered the study. Increased maternal education has been theorized to lead to increased cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example,

7. Duggan et al. (2018).

8. Rimm-Kaufman and Pianta (2000); Portilla et al. (2014).

9. Blair and Razza (2007); Gathercole, Lamont, and Alloway (2006); Bull and Scerif (2001); Andersson (2007); Blair and Peters (2003); Obradović (2010).

the family investment model).¹⁰ Research has found potential causal links between increased maternal education and children’s cognitive skills. For example, a propensity-score weighted regression analysis indicated that increases in maternal education were positively associated with increases in children’s standardized cognitive scores.¹¹ In correlational research, higher parental education has predicted higher executive function scores.¹²

- **Parenting**

- **Parent support for learning and literacy at 15 months:** Parental support for learning and literacy was measured in the MIHOPE 15-month in-home assessment from a combination of interview items and observations. It is theorized to lead to increased cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example, the family investment model).¹³ Prior experimental research has found that parental support for language and learning at 24 months mediates the effects of home visiting on children’s cognitive skills and sustained attention to objects at 36 months.¹⁴ Correlational research has also found a link between cognitive stimulation and children’s executive functioning.¹⁵

- **Parental sensitivity at 15 months:** Parental sensitivity describes the extent to which the mother takes the child’s perspective, perceives the child’s signals, and promptly responds to these signals. In MIHOPE, trained observers coded this measure from videotaped semi-structured play interactions during the 15-month in-home assessment. Parental sensitivity is theorized to lead to increased cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example, the family investment model).¹⁶ Prior experimental research has found that emotional support—an aspect of parental sensitivity—at 24 months mediates the effects of home visiting on children’s cognitive skills at 36 months.¹⁷ In another experiment, the Attachment and Biobehavioral Catch-up intervention, which aimed to increase parental sensitivity, had positive effects on children’s cognitive flexibility.¹⁸ Correlational research also supports a link between parental sensitivity and children’s executive functions.¹⁹

10. Conger and Donnellan (2007); Mayer (1997).

11. Harding (2015).

12. Halse et al. (2019); Morales et al. (2024); Conway, Waldfogel, and Wang (2018).

13. Conger and Donnellan (2007); Mayer (1997).

14. Love et al. (2002); Raikes et al. (2014).

15. Obradović, Yousafzai, Finch, and Rasheed (2016); Harden and Whittaker (2011); Rosen et al. (2020); Hackman, Gallop, Evans, and Farah (2015).

16. Conger and Donnellan (2007); Mayer (1997).

17. Raikes et al. (2014).

18. Lewis-Morrarty et al. (2012).

19. Blair, Raver, Berry, and Family Life Project Investigators (2013); Hackman, Gallop, Evans, and Farah (2015).

- **Parenting distress at 15 months:** Parenting distress is a type of parenting stress that was self-reported by parents on the 15-month caregiver survey.²⁰ Parenting stress is theorized to lead to lower cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example, the family stress model).²¹ Prior experimental research has found evidence for parenting distress mediating the effects of home visiting on children’s sustained attention to objects at 36 months.²² Correlational research has also found that parenting stress mediates the association between food insecurity and children’s self-regulation.²³
- **Interactive shared book reading at 2.5 years:** Interactive shared book reading was self-reported on the 2.5-year caregiver survey and indicates whether the mother or someone in the household talks to the child or asks the child questions most of the time when typically looking at or reading books. Parent-child book reading has been theorized to lead to increased cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example, the family investment model).²⁴ Prior experimental research has found that reading to the child daily at 24 months mediates the effects of home visiting on children’s cognitive skills at 36 months.²⁵ In correlational research, home literacy has also been linked to children’s executive functions.²⁶
- **Amount of reading per day at 3.5 years:** Amount of reading per day was self-reported on the 3.5-year caregiver survey and indicates the average number of minutes the mother or a family member read to the child per day in the past week. Parent-child book reading has been theorized to lead to increased cognitive skills for children, both in the logic models for the home visiting models included in MIHOPE and by developmental psychologists (for example, the family investment model).²⁷ Prior experimental research has found that reading to the child daily at 24 months mediates the effects of home visiting on children’s cognitive skills at 36 months.²⁸ In correlational research, home literacy has also been linked to children’s executive functions.²⁹
- **Child development**
 - **Child follows instructions at 3.5 years:** Child follows instructions is based on one item from the 3.5-year caregiver survey that asks how often the child can follow instructions

20. At the 15-month follow-up, this outcome was also referred to as “parental distress.”

21. Conger and Conger (2002).

22. Love et al. (2002).

23. Encinger et al. (2020); Gee and Asim (2019).

24. Conger and Donnellan (2007); Mayer (1997).

25. Love et al. (2002).

26. Korucu, Litkowski, and Schmitt (2020).

27. Conger and Donnellan (2007); Mayer (1997).

28. Love et al. (2002).

29. Korucu, Litkowski, and Schmitt (2020).

to complete a simple activity. Given that children’s behavioral self-regulation reflects a behavioral manifestation of children’s underlying executive functions, the analysis included children’s ability to follow instructions at 3.5 years in the mediation model to control for a sustained impact in this outcome. Variables accounting for a sustained impact were included in the mediation analysis to answer the question of whether an impact was simply sustained from an earlier wave of MIHOPE or if other mechanisms contribute to the kindergarten impact.

The results of this mediation analysis are shown in Appendix Table J.1. The table shows the estimates for the indirect effects. For ease of interpretation, these estimates have also been rescaled as the percent of the total effect that is accounted for by the indirect effect in the last column of the table.

Appendix Table J.1. Primary Mediation Model Results for Cognitive Flexibility

Effect	Estimate	Standard Error	P-Value	Percent Mediated
Indirect effect				
Economic circumstances				
Increase in maternal education (2.5 years)	-0.002	0.007	0.777	-2.44
Parenting				
Parental support for learning and literacy (15 months)	0.000	0.003	0.923	0.36
Parental sensitivity (15 months)	0.011	0.007	0.119	13.21
Parenting distress (15 months)	-0.001	0.002	0.736	-0.98
Interactive shared book reading (2.5 years)	0.006	0.010	0.515	8.07
Amount of reading per day (3.5 years)	-0.002	0.005	0.717	-2.29
Child development				
Child follows instructions (3.5 years)	0.011	0.012	0.333	13.98
Direct effect	0.056	0.057	0.322	—
Total effect	0.080	0.057	0.162	—
Sample size = 1,852				

SOURCE: Calculations based on the MIHOPE 15-month follow-up survey, the 15-month in-home assessment, the 15-month parent-child videotaped interaction, the 2.5-year check-in survey, the 3.5-year check-in survey, and the kindergarten direct assessments.

NOTE: Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

As a whole, the mediators explain 30 percent of the impact on cognitive flexibility at kindergarten. However, none of the individual mediators had a statistically significant indirect effect.

These findings were robust to the estimation approach (see details at the end of this appendix chapter).³⁰

MODEL 2: PARENT-CHILD DYSFUNCTIONAL INTERACTION

All four evidence-based models included in MIHOPE aim to affect parenting practices and strengthen the parent-child relationship.³¹ For this reason, the parenting outcome area was pre-specified as a priority outcome area to include in the mediation analysis. Parent-child dysfunctional interaction was selected for the mediation analysis because there were many plausible mechanisms by which outcomes from earlier data collection time periods could explain this impact. In addition, this outcome had the largest favorable effect size of the outcomes examined at kindergarten in the parenting domain.

Parent-child dysfunctional interaction assesses the extent to which the mother perceives her child as not meeting expectations and finds that interactions with the child are not reinforcing her parenting role.³² In MIHOPE, the measure of parent-child dysfunctional interaction is a subscale from the Parenting Stress Index—Short Form (PSI-SF), a commonly used measure in home visiting and developmental science literature to assess parenting stress.³³

The mediators selected for the parent-child dysfunctional interaction model were:

- **Maternal health**
 - **Depressive symptoms at 15 months:** Depressive symptoms were self-reported on the MIHOPE 15-month caregiver survey. Parental depression is theorized to lead to increased parenting stress by developmental psychologists (for example, the family stress model).³⁴ There is causal evidence pointing to a potential link between depression and parenting stress. An interpersonal psychotherapy group depression treatment for Head Start mothers had an impact on both the targeted outcome of maternal depression and parenting stress.³⁵ In the correlational literature, a systematic review found that parenting stress and depression were associated in all studies where it has been examined.³⁶ Depression has also been associated with parent-child dysfunctional interaction specifically in longitudinal studies.³⁷

30. Tests for sensitivity to confounding were not conducted because there were no statistically significant indirect effects.

31. Michalopoulos et al. (2019).

32. Abidin (1997).

33. Whiteside-Mansell et al. (2007).

34. Conger and Conger (2002).

35. Mennen et al. (2021).

36. Fang et al. (2022).

37. Thomason et al. (2014); Chang and Fine (2007).

- **Mastery at 15 months:** Mastery is the extent to which a person thinks life chances are under her control and is similar to self-efficacy. In MIHOPE, it was self-reported on the 15-month caregiver survey. Parental self-efficacy is theorized to lead to decreased parenting stress by developmental psychologists (for example, the family stress model).³⁸ Correlational research has also found associations between mastery and parent-child dysfunctional interaction.³⁹
- **Economic circumstances**
 - **Food insecurity at 15 months:** Food insecurity was self-reported on the MIHOPE 15-month caregiver survey. It is theorized to lead to increased parenting stress by developmental psychologists (for example, the family stress model).⁴⁰ In correlational research, parenting stress has been found to mediate the association between food insecurity and parenting and child outcomes.⁴¹
 - **Receipt of SNAP benefits at 2.5 years:** Receipt of SNAP benefits was self-reported on the MIHOPE 2.5-year caregiver survey. Increased material well-being via benefit receipt is theorized to lead to decreased parenting stress by developmental psychologists (for example, the family stress model).⁴² In a quasi-experimental study using an instrumental variables approach, SNAP receipt was associated with reduced parenting stress.⁴³ In correlational research, SNAP participation has been associated with decreased parenting stress in most studies where it has been examined.⁴⁴
- **Intimate partner violence**
 - **Experience with physical or sexual violence or battering at 15 months:**⁴⁵ Intimate partner violence was self-reported on the MIHOPE 15-month caregiver survey. Intimate partner violence is theorized to lead to increased parenting stress by developmental psychologists (for example, family systems theory; ABC-X model of family stress and coping).⁴⁶ Prior research has found that reductions in intimate partner violence medi-

38. Conger and Conger (2002).

39. Chang and Fine (2007).

40. Conger and Conger (2002).

41. Marçal (2022), Gee and Asim (2019); Shreffler et al. (2024).

42. Conger and Conger (2002).

43. Wang, Zhao, and Nam (2021).

44. Evans et al. (2024).

45. For the purposes of the mediation analysis, two outcomes from the 15-month impact analysis were combined. The mediator was defined as whether the mother had experienced physical or sexual violence or had experienced battering at the 15-month follow up.

46. Bowen (1978); Hill (1958); the ABC-X model consists of four components: how a family will respond to a stressor event (A) depends on their resources (B) and perception (C). Crisis (X) occurs when a family is unable to adapt to a stressor.

ate home visiting impacts on parenting stress.⁴⁷ Correlational research has also found associations between intimate partner violence victimization and parenting stress.⁴⁸

- **Parenting**

- **Parenting distress at 15 months:** Parenting distress, another aspect of parenting stress, is measured in MIHOPE using a subscale of the same measure used for parent-child dysfunctional interaction—the PSI-SF. The associations between these subscales are rarely a subject of research, however. Researchers typically examine their associations with other measures separately or use the PSI-SF total score. Because much of the literature that was relevant for mediator selection used the PSI-SF total score, and due to the moderate correlation between these two sub-scales of the PSI-SF, both subscales are included in the model as representing a potential sustained impact from 15 months.
- **Parent-child dysfunctional interaction at 15 months:** Parent-child dysfunctional interaction at 15 months is included in the model to account for a sustained impact. Variables measuring the same outcome at earlier waves were included in the mediation analysis to help parse whether an impact was simply sustained from an earlier wave of MIHOPE or if additional mechanisms contribute to the kindergarten impact.

- **Child development**

- **Child behavior problems at 15 months:** Child behavior problems was assessed as part of the MIHOPE 15-month caregiver survey. It is theorized to lead to increased parenting stress by developmental psychologists (for example, transactional models of development, ABC-X model of family stress and coping).⁴⁹ Correlational research has found an association between child behavior problems and parenting stress in all studies where it has been examined.⁵⁰ Longitudinal research shows that parent-child dysfunctional interaction and child behavior problems have a bi-directional relationship over time.⁵¹

The indirect effects for the mediators of the impact on parent-child dysfunctional interaction are shown in Appendix Table J.2.

As a whole, the mediators explained 46 percent of the impact on parent-child dysfunctional interaction. The only mediator with a statistically significant indirect effect was parent-child dysfunctional interaction at 15 months, which explained 29 percent of the impact. In other words, a little under a third of the kindergarten impact on parent-child dysfunctional interac-

47. Easterbrooks, Fauth, and Lamoreau (2021).

48. Owen, Thompson, and Kaslow (2006); Renner and Boel-Strudt (2013); Renner (2009).

49. Sameroff and Chandler (1975); Hill (1958).

50. Fang et al. (2022).

51. Goodrum et al. (2021); Cherry, Gerstein, and Ciciolla (2019); Jiang, Wang, Yang, and Choi (2021).

**Appendix Table J.2. Primary Mediation Model Results
for Parent-Child Dysfunctional Interaction**

Effect	Estimate	Standard Error	P-Value	Percent Mediated
Indirect effect				
Maternal health				
Depressive symptoms (15 months)	-0.002	0.004	0.585	2.35
Mastery (15 months)	-0.002	0.003	0.583	1.52
Economic circumstances				
Food insecurity (15 months)	-0.002	0.004	0.527	2.26
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits (2.5 years)	0.004	0.006	0.472	-4.23
Intimate partner violence				
Experience with physical or sexual violence or battering (15 months)	-0.010	0.008	0.230	9.97
Parenting				
Parenting distress (15 months)	-0.004	0.003	0.271	3.61
Parent-child dysfunctional interaction (15 months)	-0.029	0.013	0.027	28.80
Child development				
Child behavior problems (15 months)	-0.002	0.002	0.350	1.78
Direct effect	-0.054	0.042	0.206	—
Total effect	-0.099	0.044	0.026	—
Sample size = 2,327				

SOURCE: Calculations based on the MIHOPE 15-month follow-up survey, the 2.5 year check-in survey, and the kindergarten caregiver survey.

NOTE: Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

tion is explained by the sustained effect from the same measure at 15 months. Other factors that were not included in this analysis explain more than half of this impact.

These findings were generally robust to the estimation approach. In the causal mediation analysis, the indirect effect for parent-child dysfunctional interaction was statistically significant. However, there was an additional statistically significant mediator in that model. These findings were robust to omitted variables bias. See details at the end of this appendix.

MODEL 3: FOOD INSECURITY

Food insecurity—whether a family lacks regular access to enough safe and nutritious food for normal growth and development—is an indicator of a family’s degree of economic security. Approximately 13 percent of households with children in the United States report being food insecure.⁵² However, that percentage was much higher among the women in MIHOPE at baseline: more than half reported that their household had experienced food insecurity in the past year.⁵³

Food insecurity is a significant public health issue, given the associations between food insecurity and poor outcomes for children.⁵⁴ While food insecurity is closely related to income, numerous factors besides income have been shown to influence whether a household is food insecure, such as maternal mental and physical health. Factors besides income may help explain why almost 60 percent of children in households close to the poverty line are in food *secure* households.⁵⁵

When relevant for families, home visiting programs may focus on improving a family’s economic circumstances by supporting coordination and referrals to community resources, including federal programs such as SNAP or WIC benefits. The mediation analysis can contribute to understanding the factors that affect participation and take-up in those programs by examining potential pathways to explain how participation in home visiting services is related to food insecurity at the transition to formal schooling.

The mediators selected for the food insecurity model were:

- **Maternal health**
 - **Health insurance coverage for the mother at 15 months:** Health insurance coverage for the mother indicates whether the mother had health insurance coverage at the 15-month follow-up point. It is based on both Medicaid enrollment data and items from the 15-month caregiver survey that ask about insurance. Health insurance coverage is theorized to lead to reductions in food insecurity (for example, the cycle of food insecurity and chronic disease).⁵⁶ A quasi-experiment using a difference-in-difference design found that Medicaid coverage is associated with a reduction in food insecurity.⁵⁷ Increased Medicaid enrollment during Medicaid expansion was also associated with reductions in food insecurity.⁵⁸

52. Rabbitt, Hales, Burke, and Coleman-Jensen (2023).

53. Michalopoulos et al. (2015).

54. Johnson and Markowitz (2018); Gundersen and Ziliak (2014).

55. Gundersen and Ziliak (2014).

56. Seligman and Schillinger (2010).

57. Himmelstein (2019).

58. Londhe, Ritter, and Schlesinger et al. (2019).

- **Depressive symptoms at 15 months:** Depressive symptoms were self-reported on the MIHOPE 15-month caregiver survey. Maternal depression is theorized to lead to increased food insecurity (for example, stress theory, life course theory).⁵⁹ Correlational research has found links between depression and food insecurity, even when accounting for other factors such as household income.⁶⁰ Longitudinal studies have shown that depression at earlier time points is associated with food insecurity two years later.⁶¹
- **Health status self-rated as “poor” or “fair” at 15 months:** Maternal health is theorized to be related to food insecurity (for example, the cycle of food insecurity and chronic disease).⁶² Longitudinal correlational research has found that lower current health status can lead to an increased probability of future food insecurity.⁶³
- **Mastery at 15 months:** Mastery is the extent to which a person thinks life chances are under her control and is similar to self-efficacy. In MIHOPE, it was self-reported on the 15-month caregiver survey. Maternal self-efficacy is theorized to lead to reductions in food insecurity (for example, Bandura’s social cognitive theory).⁶⁴ In a randomized controlled trial of the Freshplace food pantry intervention, self-efficacy was associated with decreased food insecurity.⁶⁵ Correlational research also supports an association between maternal mastery and reduced food insecurity.⁶⁶
- **Health status self-rated as “poor” or “fair” at 2.5 years:** Maternal health is theorized to be related to food insecurity (for example, the cycle of food insecurity and chronic disease).⁶⁷ Longitudinal correlational research has found that lower current health status can lead to an increased probability of future food insecurity.⁶⁸
- **Economic circumstances**
 - **Food insecurity at 15 months:** Food insecurity was self-reported on the MIHOPE 15-month caregiver survey. Food insecurity at 15 months is included in the mediation model to account for a sustained impact on this measure from the 15-month follow-up. Variables measuring the same outcome at earlier waves were included in the mediation analysis to help parse whether an impact was simply sustained from an earlier wave of MIHOPE or if additional mechanisms contribute to the kindergarten impact.

59. Lazarus and Folkman (1987); Elder (1996); Giele and Elder (1998).

60. Casey et al. (2004); Melchior et al. (2009).

61. Hernandez, Marshall, and Mineo (2014).

62. Seligman and Schillinger (2010).

63. McLeod and Veall (2007).

64. Bandura (1986).

65. Martin, Colantonio, Picho, and Boyle (2016).

66. Laraia, Siega-Riz, Gundersen, and Dole (2006); Koury et al. (2020).

67. Seligman and Schillinger (2010).

68. McLeod and Veall (2007).

- **Increase in maternal education at 2.5 years:** Increase in maternal education since baseline indicates whether the mother increased her highest level of education since the time she entered the study. Increased maternal education is theorized to lead to increased economic self-sufficiency and reductions in food insecurity (for example, rational choice theory, human capital theory, self-efficacy theory).⁶⁹ Correlational research has found that one additional year of maternal education is associated with a 15 percent lower risk of being food insecure.⁷⁰
- **Receipt of SNAP benefits at 2.5 years:** Receipt of SNAP benefits was self-reported on the MIHOPE 2.5-year caregiver survey. Benefit receipt is theorized to lead to reductions in food insecurity (for example, household production theory, “nudge” theory).⁷¹ Quasi-experimental evidence has found that SNAP receipt reduces food insecurity.⁷² Correlational research also supports this association.⁷³
- **Receipt of WIC benefits at 2.5 years:** Receipt of WIC benefits was self-reported on the MIHOPE 2.5-year caregiver survey. Benefit receipt is theorized to lead to reductions in food insecurity (for example, household production theory, “nudge” theory).⁷⁴ Quasi-experimental research has found that family food insecurity increases when children age out of eligibility for WIC.⁷⁵ WIC has also been associated with lower food insecurity in correlational research.⁷⁶
- **Intimate partner violence**
 - **Experience with physical or sexual violence or battering at 15 months:**⁷⁷ Intimate partner violence was self-reported on the MIHOPE 15-month survey. Intimate partner violence is theorized to be related to food insecurity (for example, life course theory).⁷⁸ Longitudinal research has found that mothers’ experiences of intimate partner violence predicted household food insecurity two years later.⁷⁹ Cross-sectional research has also found a link between intimate partner violence and food insecurity.⁸⁰

69. Becker (1965); Bandura (1986); Becker (1962).

70. Gorman, McCurdy, Kisler, and Metallinos-Katsaras (2017).

71. Becker (1965); Thaler and Sunstein (2008).

72. Mabli et al. (2013); Ratcliffe and McKernan (2010).

73. Bartfield and Dunifon (2006); Nord and Golla (2009).

74. Becker (1965); Thaler and Sunstein (2008).

75. Artaega, Heflin, and Gable (2016).

76. Kreider, Pepper, and Roy (2016).

77. For the purposes of the mediation analysis, two outcomes from the 15-month impact analysis were combined. The mediator was defined as whether the mother had experienced physical or sexual violence or had experienced battering at the 15-month follow-up.

78. Elder (1996); Giele and Elder (1998).

79. Hernandez, Marshall, and Mineo (2014).

80. Melchoir et al. (2009); Moraes et al. (2016).

The indirect effects for the mediators of the impact on food insecurity are shown in Appendix Table J.3.

Appendix Table J.3. Primary Mediation Model Results for Food Insecurity

Effect	Estimate	Standard Error	P-Value	Percent Mediated
Indirect effect				
Maternal health				
Health insurance coverage for the mother (15 months)	0.002	0.004	0.630	-1.47
Depressive symptoms (15 months)	-0.003	0.009	0.768	2.23
Health status self-rated as “poor” or “fair” (15 months)	0.000	0.008	0.962	-0.35
Mastery (15 months)	0.000	0.003	0.895	0.39
Health status self-rated as “poor” or “fair” (2.5 years)	0.005	0.006	0.370	-4.56
Economic circumstances				
Food insecurity (15 months)	-0.037	0.027	0.179	31.47
Increase in maternal education (2.5 years)	-0.006	0.005	0.293	4.85
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits (2.5 years)	-0.011	0.009	0.220	9.64
Receipt of Women, Infants, and Children Program (WIC) benefits (2.5 years)	0.017	0.014	0.210	-14.57
Intimate partner violence				
Experience with physical or sexual violence or battering (15 months)	-0.006	0.011	0.569	5.35
Direct effect	-0.078	0.072	0.277	—
Total effect	-0.117	0.072	0.107	—
Sample size = 2,348				

SOURCE: Calculations based on the MIHOPE 15-month follow-up survey, the 2.5 year check-in survey, and the kindergarten caregiver survey.

As a whole, the mediators explained 33 percent of the impact on food insecurity. None of the mediators had statistically significant indirect effects.

These findings were robust to the estimation approach (see details at the end of this appendix).⁸¹

81. Tests for sensitivity to confounding were not conducted because there were no statistically significant indirect effects.

SUMMARY AND IMPLICATIONS

Overall, the mediation analyses did not find evidence that impacts found in earlier waves of MIHOPE explain the impacts on cognitive flexibility, parent-child dysfunctional interaction, or food insecurity at the kindergarten follow-up. However, there was a statistically significant indirect effect of a sustained impact of parent-child dysfunctional interaction at 15 months, which explains approximately 30 percent of the effect of home visiting on parent-child dysfunctional interaction at kindergarten. This sustained finding highlights how home visiting in early childhood has the potential to disrupt emotionally dysregulated patterns in the parent-child relationship, creating a more positive trajectory for the parent-child bond, a stated goal of the models' logic models.

There are two reasons that the mediation analysis was likely unable to detect other indirect effects. First, the magnitudes of the impacts on cognitive flexibility, parent-child dysfunctional interaction, and food insecurity are small. Because of this, an indirect effect needed to be relatively large (as a proportion of the impact) in order for the analysis to have enough statistical power to detect it. Second, the mechanisms leading to these impacts appear to be complex. Each of the three outcomes examined had some mediators with indirect effects that accounted for at least five percent of the impact but were not statistically significant. Taken together, these indirect effects explained at least 30 percent of the impact on each of the three outcomes. This complex pattern of multiple mediators, each explaining a small part of the impact, is more difficult to detect statistically than a single mediator accounting for the same total indirect effect.

Even so, a large proportion of these three impacts was not accounted for by the mediators included in the analyses. This may be due to measurement error in either or both the mediators and the outcomes. Alternatively, though MIHOPE collected a robust set of outcomes over time, other factors that were not measured in MIHOPE could explain the kindergarten impacts. For example, home visiting could increase mothers' awareness of community resources for nutrition services, allowing them to utilize those resources and reduce their household food insecurity in times of need. Or home visiting may have informed mothers about enrollment opportunities in high-quality preschool settings in their communities, settings which in turn may have promoted their children's cognitive flexibility skills during this sensitive period of brain development. Future research should continue to investigate the mechanisms through which home visiting has long-term effects on families.

OUTCOME AND MEDIATOR SELECTION

This section begins with an overview of the outcome and mediator selection process. Then it provides a more detailed rationale for the inclusion of the outcomes and mediators that were used in the MIHOPE mediation analysis.

Outcome Selection Criteria

Outcomes for the mediation analysis were selected from those that are statistically significantly impacted by home visiting at kindergarten. There are nine individual outcomes that had statistically significant impacts at kindergarten: perceived social support, parent-child dysfunctional interaction, number of children's books in the home, cognitive flexibility, maternal experience with battering, quarters employed in the past year, average quarterly earnings in the past year, food insecurity, and number of material hardships in the past year.

The primary criteria used to select which of these nine kindergarten outcomes to include in mediation models were:

- The outcome is in one of the pre-specified priority outcome areas—child functioning and parenting—or may be particularly relevant for policy or practice.
- The outcome is not in one of the pre-specified priority outcome areas and there is not another outcome in the same outcome area with a stronger case for prioritization.
 - To determine which outcome had a stronger rationale within an outcome area, the study team considered:
 - The relative strength of the rationale for the proposed mediators for a particular outcome.
 - The program and policy relevance of the specific outcome.
 - The effect sizes of the impacts on each outcome (larger effects were prioritized).

The criteria for each outcome were considered. In addition, the rationales for all nine outcomes were considered as a group, to ensure the full set of proposed models could contribute to understanding potential mechanisms and their potential to spotlight varied and complementary aspects of family functioning.

Mediator Selection Criteria

Because the selection of outcomes depended on the strength of the rationale for the proposed mediators for each outcome, the mediator selection criteria is presented in this section, followed by the rationale for the selection of outcomes.

All outcomes that were statistically significantly impacted by home visiting at earlier waves of MIHOPE (15 months, 2.5 years, or 3.5 years) were considered as potential mediators. Several pieces of information were used to determine whether these potential mediators should be used as mediators for a particular kindergarten outcome. The review included conceptually similar mediators or outcomes if the exact measures were not examined. For example, the review of the models' logic models for the cognitive flexibility outcome

included broadly defined child development outcomes, such as “school readiness,” and the empirical review for that outcome was expanded to include measures of executive functions more generally. As another example, the empirical review for the potential mastery mediator included measures of self-efficacy, a closely related construct. Information was reviewed in two stages to see if criteria were met.

The following information was considered in the first stage:

- Whether the **variable could account for a sustained impact** from earlier waves of MIHOPE. (For example, for the kindergarten *food insecurity* outcome, whether there was a statistically significant impact on the 15-month food insecurity outcome.)
- **Evidence of mediation from prior experimental studies** of one of the four home visiting models included in MIHOPE.
- **Logic models** from the four evidence-based home visiting models included in MIHOPE. Logic models were examined to determine if they indicated that the mediator (or a conceptually similar measure) is hypothesized to precede the outcome in the home visiting model’s theory of change.⁸²
- **Theoretical frameworks** from a range of social science disciplines, including developmental psychology, sociology, health, and economics. Theoretical frameworks were considered to support the inclusion of the mediator if the theory indicates that the mediator in question leads to or has potential implications for the outcome in question.
- Whether the mediator-outcome pair had at least a **modest correlation** in the MIHOPE data, which was defined as at least $r = |0.09|$ in magnitude.

These comparatively narrow searches and reviews were used to determine if there was any reason to move forward with broader searches and empirical review. If a potential mediator-outcome pair met any of these criteria, it was investigated further in the second stage of the process.

In the second stage, the empirical evidence from the broader literature was considered to further strengthen the justification for inclusion in the model.

- **Prior causal evidence from other literature.** Two types of studies were considered causal evidence: (1) experimental or quasi-experimental studies that conducted a formal mediation analysis and found a statistically significant indirect effect of the potential mediator in question in explaining an impact on the outcome in question, and (2) experimental or

82. U.S. Department of Health and Human Services, Administration for Children and Families, Office of Head Start (2025); Healthy Families America logic model; Nurse-Family Partnership logic model; and Parents as Teachers National Center (2023). The Healthy Families America and Nurse-Family Partnership logic models were obtained from communication with the model developers.

quasi-experimental studies that directly targeted the potential mediator of interest and also had an impact on the outcome of interest (even if there is no formal test of mediation). For example, if an intervention providing therapy for mothers with depression had an impact on both depression and parenting stress, that would be considered evidence for a causal relationship between higher levels of depressive symptoms leading to increased parenting stress.

- Experimental and quasi-experimental studies that did not meet one of the two requirements above (in other words, that did not conduct a formal mediation nor directly target the mediator) that had an impact on both the potential mediator and outcome under consideration in MIHOPE were *not* considered to be causal evidence of the relationship between the mediator-outcome pair. For example, a parenting intervention that had an impact on both food insecurity and depression would not count as evidence for a causal relationship between food insecurity and depression.
- **Prior correlational evidence from other literature.** The review of correlational literature prioritized studies that used the same constructs as the mediator-outcome pair under consideration and were longitudinal studies that established the temporal order in the direction of interest between the mediator-outcome pair. If this evidence was limited, the search expanded to studies that used similar constructs (rather than the same constructs) and/or cross-sectional studies that showed a relationship between the mediator-outcome pair.

Following these two stages of review, the strength of the rationale for each mediator's inclusion was assessed, considering:

- **Sustained impact.** Given the importance of controlling for a sustained impact, mediators that met this criterion were included in the model, regardless of whether the mediator met the other criteria.
- **Prior evidence of home visiting mediation.** Given the mediation analysis is occurring within a home visiting context, direct evidence of mediation within the context of the four home visiting models included in MIHOPE is considered a strong rationale and thus warrants inclusion in the model, regardless of whether the mediator met the other criteria.
- **The final count of criteria** that were met from both stages of review.
- **The information gathered in the review of each criterion** (for example, the strength of the causal evidence available from other literature).

The final count of criteria that were met for each potential mediator was used as a point of information to inform decision making, but cutoffs were not imposed based solely on these counts. The information gathered during both stages of the review was also assessed qualitatively. All mediators with a similarly strong rationale were selected for each outcome, but the meaning of “strong rationale” for the purposes of inclusion in the models was dependent

on the evidence available for each outcome of interest. The number of mediators selected for a given outcome depended on how many potential mediators had a similarly strong rationale across all the selection criteria.

Rationale for Kindergarten Outcomes included in Mediation Analyses

Outcomes for mediation analysis were selected from two groups. First, outcomes in the priority areas that were pre-specified in the study's analysis plan—child functioning and parenting—were selected. Then, outcomes in other outcome areas were selected.

Review of Outcome Areas Pre-Specified as Priorities for Mediation Analysis

As pre-specified in the analysis plan and mentioned above, outcomes in the child functioning and parenting outcome areas were considered most relevant to model.

Cognitive flexibility was selected as it is the only candidate from the child functioning outcome area. Although the omnibus test that includes this measure was not statistically significant, modeling cognitive flexibility offered an opportunity to examine a path to a measure of executive functions. Further, the two-stage review described above resulted in a number of potential mediators that met the inclusion criteria.

The two outcomes in the parenting outcome area—parent-child dysfunctional interaction and number of children's books in the home—were considered next. Based on the two-stage review, parent-child dysfunctional interaction resulted in a more strongly justified set of mediators that met the inclusion criteria than number of books, as prior home visiting literature has focused more on parent reading *practices* and not on the number of books in the home, per se. The effect size was also slightly larger for parent-child dysfunctional interaction (-0.09) versus number of books (0.06). For these reasons, parent-child dysfunctional interaction was selected as an outcome to be modeled.

Outcome Areas Not Pre-Specified as Priority Areas for Mediation Analysis

After reviewing the potential child functioning and parenting outcomes, the team considered the six outcomes from outcome areas that had not been pre-specified as priority areas to examine via mediation in the analysis plan: perceived social support, maternal experience with battering, employment, earnings, food insecurity, and material hardship. The text that follows describes what was considered for each of these outcomes and how the team selected the outcomes to model.

First, “perceived social support” and “maternal experience with battering” were considered and determined to be not viable outcomes to model. Neither outcome is mentioned in any of the four evidence-based home visiting models' logic models, and few theories address what may cause either of these outcomes. Social support is more typically mentioned in theories as a moderating or buffering mechanism, and theories of intimate partner violence more typically explain perpetration, rather than victimization, given that they are the parties

responsible for the occurrence. Although some potential mediators advanced to the second stage of the two-stage review process due to correlations in the MIHOPE data, for the most part, the literature review did not include studies that support the causal order of the mediator causing the outcome. More typically, the research had considered the mediator-outcome relationship in the opposite causal direction. Although a few mediators did have evidence of a bidirectional or reciprocal relationship with these outcomes, there was not a strong enough justification from theory or prior evidence to model these outcomes.⁸³

Next, the four economic circumstances outcomes were considered. Given that there are several statistically significant impacts in this policy-relevant outcome area, it was important to potentially examine one outcome from this outcome area.

The two potential outcomes from the material hardship sub-area (food insecurity and material hardship) were considered in conjunction because both outcomes are indicative of families' challenges addressing needs, which is something home visiting aims to improve and is foundational to families' abilities to engage in services and improve other outcomes.⁸⁴ Food insecurity was selected as the more promising of the two outcomes to model. This is primarily because food insecurity is more clearly defined, whereas there is no consensus on a definition of material hardship in the literature.⁸⁵ The material hardship outcome is represented by a total count of different types of circumstances, which include hardships related to paying rent or mortgage, housing instability, utility bills, foregoing medical care due to cost, or running out of money between paychecks. In the context of examining mediating pathways, being able to model more specific pathways to food insecurity (a more narrowly defined hardship) by including mediators that have more solid empirical evidence of relationships to this specific type of hardship aids in interpretation and may potentially result in more actionable interpretations, such as more targeted efforts by home visiting services to increase take-up of programs aimed at reducing food insecurity.

The employment and earnings outcomes were considered next. Both earnings and employment had potential mediators that were associated with these outcomes in the MIHOPE data and had correlational evidence, such as increase in maternal education, mastery, and health status self-rated as "poor" or "fair."

However, while any of the four economic circumstances outcomes at kindergarten would be compelling to model, food insecurity was selected as the outcome to model to further enhance understanding of the complexities of family functioning in the context of home visiting. While home visiting programs aim to improve families' economic circumstances in a variety of ways—including connecting them to employment opportunities—food insecurity was determined to be a stronger outcome to model for this outcome area. Food insecurity

83. Joiner and Timmons (2002); Rudolph (2008); Lazarus and Folkman (1984); Goodman and Smyth (2011); Dunham and Senn (2000); Cherrier, Courtois, Rusch, and Potard (2023); Papadakaki, Tzamalouka, Chatzifotiou, and Chliaoutakis (2009).

84. Maslow (1958).

85. Beverly (2001).

is more indicative of a family's experience of actual hardship and whether a family's immediate needs are met. While employment can offer long-term stability and opportunities for upward mobility, employment alone cannot guarantee that a family's needs are being met; for instance, underemployment or low-wage jobs may not provide enough money to cover a family's expenses. And while earnings can reflect a family's capacity to meet a range of needs, it does not account for job security or financial strain if the cost of living is high or if families have unexpected expenses or high debt. Additionally, increased earnings may result in no longer being eligible for public benefits like SNAP, housing or childcare subsidies, potentially creating a situation in which families at those eligibility thresholds are financially worse off despite earning more.⁸⁶

Rationale for Mediators Included in Mediation Analyses

The rationale for inclusion of each mediator used in the mediation analysis is described in the first section of this appendix. Appendix Tables J.4 to J.6 provide a snapshot of the two-stage review process for all mediators that were considered, along with the final criteria count that informed the final models to include in the mediation analyses.

86. Anderson et al. (2022).

Appendix Table J.4. Pool of Mediators Examined for Inclusion in the Cognitive Flexibility Model

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Maternal health									
Health insurance coverage for the mother	15m	—	—	—	—	—	NE	NE	0
Substance use	15m	—	—	✓	✓	—	—	—	2
Depressive symptoms	15m	—	—	✓	✓	—	—	✓	3
Health status self-rated as “poor” or “fair”	15m	—	—	—	—	—	NE	NE	0
Mastery	15m	—	—	—	✓	—	—	✓	2
Health status self-rated as “poor” or “fair”	2.5y	—	—	—	—	—	NE	NE	0
Economic circumstances									
Food insecurity	15m	—	—	✓	✓	—	—	✓	3
Received any transportation services	15m	—	—	—	—	—	NE	NE	0
Increase in maternal education	2.5y	—	—	✓	✓	—	✓	✓	4
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits	2.5y	—	—	✓	✓	—	—	—	2
Receipt of Women, Infants, and Children Program (WIC) benefits	2.5y	—	—	✓	✓	—	—	—	2
Intimate partner violence^a									
Maternal experience with physical or sexual violence	15m	—	—	—	✓	—	✓	✓	3
Experience with battering	15m	—	—	—	✓	—	✓	✓	3
Received any domestic violence services	15m	—	—	—	—	—	NE	NE	0
Received any services from a domestic violence shelter	15m	—	—	—	—	—	NE	NE	0

(continued)

Appendix Table J.4 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Parenting									
Quality of the home environment	15m	—	—	✓	✓	✓	✓	✓	5
Parental support for learning and literacy	15m	—	✓	✓	✓	✓	—	✓	PHVM
Parental sensitivity	15m	—	✓	✓	✓	✓	✓	✓	PHVM
Gentle guidance	15m	—	—	✓	✓	✓	—	—	3
Parenting distress	15m	—	✓	✓	✓	—	—	✓	PHVM
Parent-child dysfunctional interaction	15m	—	—	—	✓	—	—	✓	2
Awareness of health and safety hazards	15m	—	—	✓	—	—	—	—	1
Interactive shared book reading	2.5y	—	✓	✓	✓	—	—	✓	PHVM
Amount of reading per day	3.5y	—	✓	✓	✓	—	—	✓	PHVM
Did arts and crafts with child	3.5y	—	—	✓	✓	—	—	✓	3
Composite of in-home learning activities	3.5y	—	—	✓	✓	—	—	✓	3
Child maltreatment									
Frequency of psychological aggression	15m	—	—	✓	✓	—	—	✓	3
Any use of physical discipline	2.5y	—	—	✓	✓	—	—	✓	3
Child health									
Number of Medicaid-paid child ED visits	15m	—	—	—	—	—	NE	NE	0
Any nonbirth hospitalizations	15m	—	—	—	—	—	NE	NE	0
Had annual well-child visit	2.5y	—	—	—	—	—	NE	NE	0
Has primary care provider (PCP)	2.5y	—	—	—	—	—	NE	NE	0

(continued)

Appendix Table J.4 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Child development^b									
Child behavior problems	15m	—	—	✓	—	✓	—	✓	3
Is able to sit still	3.5y	✓	NA	NA	NA	✓	NA	NA	SI
Can keep working at something until finished	3.5y	✓	NA	NA	NA	✓	NA	NA	SI
Child follows instructions	3.5y	✓	NA	NA	NA	✓	NA	NA	SI

NOTES: ^aNot collected at 2.5 or 3.5 years.

^bNot collected at 2.5 years.

^cAutomatic inclusion criteria.

NE = not examined in detail based on initial set of criteria.

NA = not applicable because the mediator can account for a sustained impact from earlier waves of MIHOPE.

SI = represents inclusion based on a sustained impact.

PHVM = represents inclusion based on prior home visiting mediation.

Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

Appendix Table J.5. Pool of Mediators Examined for Inclusion in the Parent-Child Dysfunctional Interaction Model

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Maternal health									
Health insurance coverage for the mother	15m	—	—	—	—	—	NE	NE	0
Substance use	15m	—	—	—	—	—	NE	NE	0
Depressive symptoms	15m	—	—	—	✓	✓	✓	✓	4
Health status self-rated as "poor" or "fair"	15m	—	—	—	—	—	NE	NE	0
Mastery	15m	—	—	—	✓	✓	—	✓	3
Health status self-rated as "poor" or "fair"	2.5y	—	—	—	—	—	NE	NE	0
Economic circumstances									
Food insecurity	15m	—	—	—	✓	✓	—	✓	3
Received any transportation services	15m	—	—	—	—	—	NE	NE	0
Increase in maternal education	2.5y	—	—	—	✓	—	—	✓	2
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits	2.5y	—	—	—	✓	—	✓	✓	3
Receipt of Women, Infants, and Children Program (WIC) benefits	2.5y	—	—	—	✓	—	—	—	1
Intimate partner violence^a									
Maternal experience with physical or sexual violence	15m	—	✓	—	✓	—	—	✓	PHVM
Experience with battering	15m	—	—	—	✓	✓	—	✓	3
Received any services from a domestic violence shelter	15m	—	—	—	—	—	NE	NE	0
Received any domestic violence services	15m	—	—	—	—	—	NE	NE	0

(continued)

Appendix Table J.5 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Parenting									
Quality of the home environment	15m	—	—	—	—	✓	✓	—	2
Parental support for learning and literacy	15m	—	—	—	—	✓	✓	—	2
Parental sensitivity	15m	—	—	—	—	—	NE	NE	0
Gentle guidance	15m	—	—	—	—	—	NE	NE	0
Parenting distress	15m	✓	NA	NA	NA	✓	NA	NA	SI
Parent-child dysfunctional interaction	15m	✓	NA	NA	NA	✓	NA	NA	SI
Awareness of health and safety hazards	15m	—	—	—	—	—	NE	NE	0
Interactive shared book reading	2.5y	—	—	—	—	—	NE	NE	0
Amount of reading per day	3.5y	—	—	—	—	—	NE	NE	0
Did arts and crafts with child	3.5y	—	—	—	—	—	NE	NE	0
Composite of in-home learning activities	3.5y	—	—	—	—	—	NE	NE	0
Child maltreatment									
Frequency of psychological aggression	15m	—	—	—	—	—	NE	NE	0
Any use of physical discipline	2.5y	—	—	—	—	—	NE	NE	0
Child health									
Number of Medicaid-paid child ED visits	15m	—	—	—	✓	—	—	✓	2
Any nonbirth hospitalizations	15m	—	—	—	✓	—	—	✓	2
Had annual well-child visit	2.5y	—	—	—	—	—	NE	NE	0
Has primary care provider (PCP)	2.5y	—	—	—	—	—	NE	NE	0

(continued)

Appendix Table J.5 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Child development^b									
Child behavior problems	15m	—	—	—	✓	✓	—	✓	3
Is able to sit still	3.5y	—	—	—	—	✓	—	—	1
Can keep working at something until finished	3.5y	—	—	—	—	✓	—	—	1
Child follows instructions	3.5y	—	—	—	—	✓	—	—	1

NOTES: ^aNot collected at 2.5 or 3.5 years.

^bNot collected at 2.5 years.

^cAutomatic inclusion criteria.

NE = not examined in detail based on initial set of criteria.

NA = not applicable because the mediator can account for a sustained impact from earlier waves of MIHOPE.

SI = represents inclusion based on a sustained impact.

PHVM = represents inclusion based on prior home visiting mediation.

Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

Appendix Table J.6. Pool of Mediators Examined for Inclusion in the Food Insecurity Model

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Maternal health									
Health insurance coverage for the mother	15m	—	—	—	✓	—	✓	✓	3
Substance use	15m	—	—	—	✓	—	—	—	1
Depressive symptoms	15m	—	—	—	✓	✓	—	✓	3
Health status self-rated as “poor” or “fair”	15m	—	—	—	✓	✓	—	✓	3
Mastery	15m	—	—	—	✓	✓	✓	✓	4
Health status self-rated as “poor” or “fair”	2.5y	—	—	—	✓	✓	—	✓	3
Family economic circumstances									
Food insecurity	15m	✓	NA	NA	NA	✓	NA	NA	SI
Received any transportation services	15m	—	—	—	✓	—	—	—	1
Increase in maternal education	2.5y	—	—	—	✓	—	—	✓	2
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits	2.5y	—	—	—	✓	✓	✓	✓	4
Receipt of Women, Infants, and Children Program (WIC) benefits	2.5y	—	—	—	✓	—	✓	✓	3
Intimate partner violence^a									
Maternal experience with physical or sexual violence	15m	—	—	—	✓	✓	—	✓	3
Experience with battering	15m	—	—	—	✓	—	—	✓	2
Received any domestic violence services	15m	—	—	—	✓	—	—	—	1
Received any services from a domestic violence shelter	15m	—	—	—	✓	—	—	—	1

(continued)

Appendix Table J.6 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Parenting									
Quality of the home environment	15m	—	—	—	—	—	NE	NE	0
Parental support for learning and literacy	15m	—	—	—	—	—	NE	NE	0
Parental sensitivity	15m	—	—	—	—	—	NE	NE	0
Gentle guidance	15m	—	—	—	—	—	NE	NE	0
Parenting distress	15m	—	—	—	✓	✓	—	—	2
Parent-child dysfunctional interaction	15m	—	—	—	—	—	NE	NE	0
Awareness of health and safety hazards	15m	—	—	—	—	—	NE	NE	0
Interactive shared book reading	2.5y	—	—	—	—	—	NE	NE	0
Amount of reading per day	3.5y	—	—	—	—	—	NE	NE	0
Did arts and crafts with child	3.5y	—	—	—	—	—	NE	NE	0
Composite of in-home learning activities	3.5y	—	—	—	—	—	NE	NE	0
Child maltreatment									
Frequency of psychological aggression	15m	—	—	—	—	✓	—	—	1
Any use of physical discipline	2.5y	—	—	—	—	✓	—	—	1
Child health									
Number of Medicaid-paid child ED visits	15m	—	—	—	—	—	NE	NE	0
Any nonbirth hospitalizations	15m	—	—	—	—	—	NE	NE	0
Had annual well-child visit	2.5y	—	—	—	—	—	NE	NE	0
Has primary care provider (PCP)	2.5y	—	—	—	—	—	NE	NE	0

(continued)

Appendix Table J.6 (continued)

Potential Mediator	Time Point	First Stage Criteria					Second Stage Criteria		Final Criteria Count
		Sustained Impact ^c	Prior HV Mediation ^c	HV Logic Models	Theoretical Frameworks	MIHOPE Correlation	Causal Evidence	Correlational Evidence	
Child development^b									
Child behavior problems	15m	—	—	—	—	—	NE	NE	0
Is able to sit still	3.5y	—	—	—	—	—	NE	NE	0
Can keep working at something until finished	3.5y	—	—	—	—	—	NE	NE	0
Child follows instructions to complete a simple task	3.5y	—	—	—	—	—	NE	NE	0

NOTES: ^aNot collected at 2.5 or 3.5 years.

^bNot collected at 2.5 years.

^cAutomatic inclusion criteria.

NE = not examined in detail based on initial set of criteria.

NA = not applicable because the mediator can account for a sustained impact from earlier waves of MIHOPE.

SI = represents inclusion based on a sustained impact.

PHVM = represents inclusion based on prior home visiting mediation.

Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

ANALYTIC DETAILS AND ADDITIONAL ANALYSES

The remainder of this appendix provides more technical details used in the mediation analysis. This section provides analytic details for the analyses described earlier in this appendix. First, it provides analytic details for the primary models. Then, it provides analytic details and findings for the additional analyses, including a secondary estimation approach utilizing causal mediation analysis and tests for sensitivity to measured and unmeasured confounding variables.

Analytic Details for Primary Models

As the primary methodology, the team used path analysis, using the R package lavaan.⁸⁷ The primary path analyses utilize a system of linear regressions:

$$Y_i = \beta_{00} + \beta_{01}T_i + \beta_{02}M_{1i} + \beta_{03}M_{2i} + \dots + \beta_{1n+1}M_{ni} + \sum_1^z \phi_z W_{zi}$$
$$M_{1i} = \beta_{10} + \beta_{11}T_i + \sum_1^z \phi_z W_{zi}$$
$$M_{2i} = \beta_{20} + \beta_{21}T_i + \sum_1^z \phi_z W_{zi}$$

...

$$M_{ni} = \beta_{n0} + \beta_{n1}T_i + \sum_1^z \phi_z W_{zi}$$

Where:

Y_i = Outcome of interest

M_{ni} = A set of N mediators

W_{zi} = A set of Z baseline covariates

T_i = Indicator for whether individual i was randomly assigned to receive home visiting (=1 if individual i was randomly assigned to the intervention; =0 otherwise)

In addition, the model estimates the covariances among each pair of mediators.

For binary mediators and outcomes, the path analysis uses weighted least squares mean and variance adjusted (WLSMV).⁸⁸ This estimation approach treats binary variables as latent

87. Rosseel (2012).

88. Rosseel (2012).

continuous variables (with the binary values representing an unmeasured, true continuous distribution), so the associations are modeled linearly.⁸⁹

Indirect effects are calculated as the products of coefficients. Specifically, the estimate from the equation predicting the outcome for the mediator of interest and the estimate from the equation predicting the mediator for the program group are used. For example, the indirect effect for M_i is calculated as $\beta_{o2} * \beta_{21}$. The standard errors for indirect effects are calculated using the Delta method.⁹⁰

Missing data were handled using multiple imputation with chained equations. The data were imputed up to the sample of respondents for the data source of the kindergarten outcome. For example, data for the food insecurity model were imputed up to and including the kindergarten survey respondent sample.

Additional Analyses

Additional analyses were conducted to assess the robustness of the results of the primary mediation models. First, the primary mediation models were re-estimated using a secondary analytic approach called causal mediation analysis. Next, tests were conducted to determine the degree to which the results may be sensitive to measured and unmeasured confounding variables. This section provides analytic details, followed by the findings, for each of these analyses.

Secondary Estimation Approach: Causal Mediation Analysis

Causal mediation analysis (CMA) is a generalized method for conducting mediation analysis that calculates indirect effects non-parametrically. Although the word “causal” is in the name of this methodology, just like the results of mediation analysis using other methodologies, the results can only be interpreted causally if certain assumptions are met, which are almost always untestable and impossible to fulfill in practice.⁹¹ Therefore, the findings using this approach should be interpreted with the same amount of caution as the findings presented earlier in this appendix.

CMA uses a potential outcomes framework to estimate the expected value of the outcome under different values of the treatment (program group) status and the mediator(s).⁹² Differences in these expected values are used to calculate the direct and indirect effects. The direct effect represents the change in a kindergarten outcome from being assigned to the program group but having none of the mediators change. The indirect effect represents the change in a kindergarten outcome from being assigned to the program group and having the mediator(s) change.

89. Kaplan (2012).

90. Rosseel (2012).

91. MacKinnon and Pirlott (2015).

92. Imai, Keele, and Tingley (2010); Pearl (2001).

In causal mediation analysis, the indirect effect for any individual i is defined as:

$$\delta_i(t) = Y_i(t, M_i(1)) - Y_i(t, M_i(0))$$

Where $Y_i(t, M_i(1))$ represents the expected value of the outcome Y for an individual i , when the mediator is equal to 1, and $Y_i(t, M_i(0))$ represents the expected value of the outcome Y for individual i , when the mediator M is equal to 0. Because each individual has only one value of t (treatment group) and M (mediator) in the data, the estimates produced are *average* causal mediation effects (abbreviated as ACME).

Because the indirect effects are calculated non-parametrically, rather than as a product of coefficients, CMA can utilize a variety of statistical models—such as logistic and probit regressions—to estimate the expected values of mediators and outcomes. As mentioned above, a limitation of path analysis is that it uses a framework of linear regression, which treats variables as continuous and assumes linear relationships between the variables. For binary mediators and outcomes, the path analysis treats binary variables as latent continuous variables and models the associations linearly. The CMA is a check on this estimation strategy, using probit regression for models predicting a binary mediator or outcome.

To estimate the effects of multiple mediators simultaneously, the team used the `multmediate` R function.⁹³ This function treats the mediators similarly to the path model that was used for the primary analysis—mediators are assumed to be correlated with each other, but no causal order among the mediators is imposed.

The CMA model could not support the inclusion of all covariates that were included in the primary path analysis due to model overfitting. The covariate list was reduced to the evidence-based home visiting model implemented at the mother's random assignment site, maternal education, and the baseline version of the outcome measure, if available. To isolate the difference in the estimation approach, the path analysis was re-estimated with this reduced set of covariates. Appendix Table J.7 shows the results of the causal mediation models, compared to the findings from the path models shown earlier in the appendix and the path models with the reduced set of covariates. The cognitive flexibility and food insecurity models were robust to the estimation approach; just as in the path analysis models, none of the indirect effects were statistically significant.

The finding that parent-child dysfunctional interaction at 15 months mediated the impact on parent-child dysfunctional interaction at kindergarten was replicated in the CMA model. However, there was also an indirect effect in the CMA model for mastery at 15 months, which did not appear in the primary path model. This appears to be partly explained by the reduced covariates, as the estimate from the path model with reduced covariates is larger than the estimate from the primary path model. However, compared to the estimate from the CMA model, the estimate from the path model with reduced covariates is still smaller and is

93. Jérolon, Baglietto, Birmelé, and Alarcon (2020).

Appendix Table J.7. Causal Mediation Analysis Findings

Mediator	Primary Path Model			Path Model with Reduced Covariates			Causal Mediation Analysis Model	
	Indirect Effect	Standard Error	P-Value	Indirect Effect	Standard Error	P-Value	Indirect Effect	P-Value
Model 1: Cognitive flexibility								
Economic circumstances								
Increase in maternal education (2.5 years)	-0.002	0.007	0.777	0.000	0.006	0.977	0.000	0.854
Parenting								
Parental support for learning and literacy (15 months)	0.000	0.003	0.923	0.001	0.003	0.770	0.001	0.563
Parental sensitivity (15 months)	0.011	0.007	0.119	0.012	0.008	0.121	0.013	0.106
Parenting distress (15 months)	-0.001	0.002	0.736	0.000	0.002	0.918	0.001	0.705
Interactive shared book reading (2.5 years)	0.006	0.010	0.515	0.006	0.010	0.552	0.004	0.284
Amount of reading per day (3.5 years)	-0.002	0.005	0.717	-0.003	0.006	0.664	-0.002	0.457
Child development								
Child follows instructions (3.5 years)	0.011	0.012	0.333	0.011	0.012	0.356	0.006	0.299
Model 2: Parent-child dysfunctional interaction								
Maternal health								
Depressive symptoms (15 months)	-0.002	0.004	0.585	-0.006	0.006	0.332	-0.004	0.239
Mastery (15 months)	-0.002	0.003	0.583	-0.005	0.003	0.180	-0.007	0.073
Economic circumstances								
Food insecurity (15 months)	-0.002	0.004	0.527	-0.003	0.004	0.487	-0.003	0.228
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits (2.5 years)	0.004	0.006	0.472	0.001	0.003	0.670	0.001	0.639
Intimate partner violence								
Experience with physical or sexual violence or battering (15 months)	-0.010	0.008	0.230	-0.012	0.008	0.136	-0.005	0.106
Parenting								
Parenting distress (15 months)	-0.004	0.003	0.271	-0.005	0.004	0.213	-0.006	0.165
Parent-child dysfunctional interaction (15 months)	-0.029	0.013	0.027	-0.032	0.014	0.022	-0.032	0.008
Child development								
Child behavior problems (15 months)	-0.002	0.002	0.350	-0.003	0.002	0.211	-0.004	0.207

(continued)

Appendix Table J.7 (continued)

Mediator	Primary Path Model			Path Model with Reduced Covariates			Causal Mediation Analysis Model	
	Indirect Effect	Standard Error	P-Value	Indirect Effect	Standard Error	P-Value	Indirect Effect	P-Value
Model 3: Food insecurity								
Maternal health								
Health insurance coverage for the mother (15 months)	0.002	0.004	0.630	0.001	0.005	0.829	0.000	0.798
Depressive symptoms (15 months)	-0.003	0.009	0.768	-0.004	0.010	0.711	-0.001	0.405
Health status self-rated as “poor” or “fair” (15 months)	0.000	0.008	0.962	-0.002	0.011	0.887	-0.001	0.421
Mastery (15 months)	0.000	0.003	0.895	0.001	0.005	0.795	0.000	0.816
Health status self-rated as “poor” or “fair” (2.5 years)	0.005	0.006	0.370	0.003	0.004	0.438	0.000	0.466
Economic circumstances								
Food insecurity (15 months)	-0.037	0.027	0.179	-0.040	0.026	0.127	-0.007	0.120
Increase in maternal education (2.5 years)	-0.006	0.005	0.293	-0.005	0.005	0.310	0.000	0.753
Receipt of Supplemental Nutrition Assistance Program (SNAP) benefits at 2.5 years:	-0.011	0.009	0.220	-0.008	0.008	0.310	-0.001	0.440
Receipt of Women, Infants, and Children Program (WIC) benefits at 2.5 years	0.017	0.014	0.210	0.015	0.012	0.217	0.002	0.218
Intimate partner violence								
Experience with physical or sexual violence or battering (15 months)	-0.006	0.011	0.569	-0.011	0.012	0.350	-0.001	0.304
Sample size = 2,348								

SOURCE: Calculations based on the MIHOPE 15-month follow-up survey, the 15-month in-home assessment, the 15-month parent-child videotaped interaction, the 2.5-year check-in survey, the 3.5-year check-in survey, the kindergarten caregiver survey, and the kindergarten direct assessments.

NOTE: Parenting distress was in the parenting outcome area at the 15-month follow-up. At the kindergarten follow-up, it is in the maternal well-being outcome area.

not statistically significant. Therefore, some of the indirect effects for this outcome appear to be sensitive to the estimation approach.

Sensitivity to Confounders

The results of mediation analysis can be affected by omitted variables bias. If there are variables that confound the relationship between the mediator and the outcome (the “*M-Y* relationship”) that were not included in the mediation analysis, the results reported above may be biased.⁹⁴

Failing to account for confounders would bias the results such that indirect effects appear larger than they truly are. In other words, omitting confounders from the model is likely to lead to false positives in the mediation findings.⁹⁵ Therefore, these tests were only conducted for mediators with statistically significant indirect effects.

Analyses were conducted to examine two types of confounders that may have biased these findings: *measured* confounders that were collected in MIHOPE after random assignment, but were not included in the mediation models, and *unmeasured* confounders that were not collected by the study.

Measured confounders. Because MIHOPE collected a large number of measures at earlier waves of follow-up, the first step in checking for omitted variable bias was to consider variables that were collected by the study but not included in the mediation analysis. When selecting mediators, only variables that had impacts at earlier waves were considered. However, variables do not have to have been impacted by home visiting to confound the *M-Y* relationship. Rather, measured confounders should be variables that can theoretically cause both the mediator and the outcome. It is important to consider the likely causal direction among the variables, as including *colliders* (which are *caused by* both the mediator and the outcome) adds bias to the results, rather than reducing it.⁹⁶

Because the MIHOPE dataset is very large, a combination of data-driven and theory-driven approaches were used to identify the potential confounders. This occurred in three steps:

1. The first step is **data-driven**. Partial correlations between outcomes measured at 15 months, 2.5 years, and 3.5 years and the mediator and outcome pair with a statistically significant indirect effect are examined. Rather than setting an arbitrary cutoff for the correlations, a Left Out Variables Error (LOVE) plot, which is a diagnostic tool typically used to assess bias due to *unmeasured* confounders, is used to determine the cutoffs.⁹⁷ The plot shows a line corresponding to when certain values of a confounder would reduce the observed indirect effect to zero. The y-axis depicts the correlation between

94. MacKinnon and Pirlott (2015); VanderWeele (2019).

95. MacKinnon and Pirlott (2015); VanderWeele (2019).

96. VanderWeele (2019).

97. MacKinnon and Pirlott (2015); Mauro (1990); Cox, Kisbu-Sakarya, Miočević, and MacKinnon. (2013).

the confounder (C) and the mediator (M), and the x-axis depicts the correlation between the confounder (C) and the outcome (Y). Using the thresholds from the LOVE plot, measures that have a strong enough correlation with both the mediator and outcome to act as potential confounders were identified. Because the mediation models are multi-mediator models and also include baseline covariates, partial correlations (controlling for the variables in the mediation model) are used in place of correlations.

2. The next step is **theory-driven**. The potential confounders identified using the partial correlations are classified as whether they were more likely to be confounders of the M - Y relationship or colliders of the M - Y relationship, using a broad range of theories from fields such as psychology, sociology, public health, and economics.
3. The final step is **re-estimation**. The primary path models are re-estimated, including the measured confounders identified as covariates in the equation predicting the outcome. If the indirect effects are no longer statistically significant, that shows that the findings are sensitive to measured confounders.

However, as described below, no measured confounders were identified in the data-driven step. Therefore, the theory-driven and re-estimation steps were not performed.

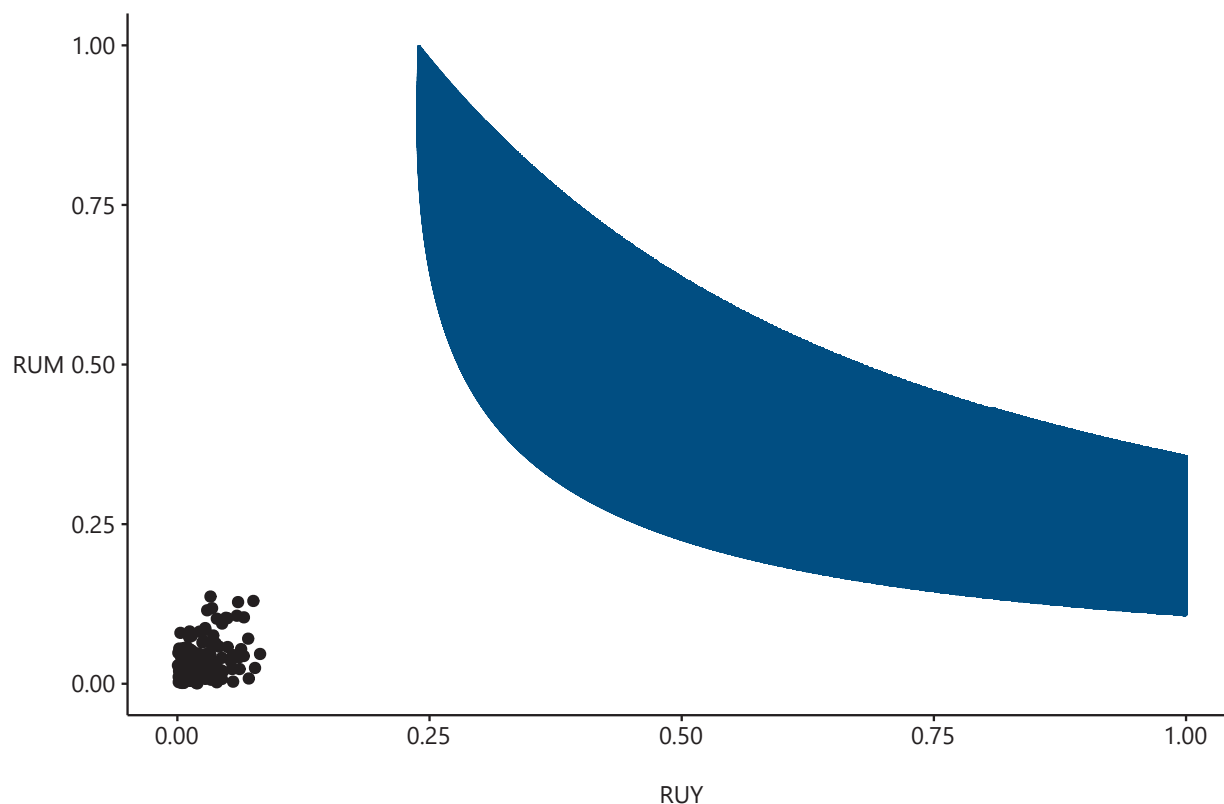
Cognitive flexibility. There were no mediators with statistically significant indirect effects, so no tests for measured confounders were conducted.

Parent-child dysfunctional interaction. The only statistically significant indirect effect for parent-child dysfunctional interaction was the same measure from the 15-month follow-up. The LOVE plot for parent-child dysfunctional interaction measured at 15 months and at kindergarten is shown in Appendix Figure J.2. The blue area shows all values of a C - M and C - Y partial correlation that would lead to the observed indirect effect being zero if C was controlled for in the model. The black dots are the observed partial correlations between measures collected at 15 months, 2.5 years, and 3.5 years and M and Y . Based on the LOVE plot, no variables were identified as potential measured confounders. As shown in the plot, all partial correlations between potential confounders and the mediator and outcome are too low for the inclusion of a measured confounder in the model to reduce the observed indirect effect to zero. Because no measured confounders were identified, the model was not re-estimated. This finding is robust to potential measured confounders.

Food insecurity. There were no mediators with statistically significant indirect effects, so no tests for measured confounders were conducted.

Unmeasured confounders. Although there are many potential measured confounders in MIHOPE, it is still possible that there could be confounding variables that the study did not collect (“unmeasured confounders”). Two tests can be used to determine the degree to which results are sensitive to some unknown, unmeasured confounder: the LOVE plot method (described above), which can be implemented for the path analysis model, and the

Figure J.2. LOVE Plot for Parent-Child Dysfunctional Interaction



SOURCES: Calculations based on the MIHOPE 15-month follow-up survey, 2.5-year check-in survey, and kindergarten caregiver survey.

NOTES: RUM = correlation (r) between an unmeasured confounder (U) and the mediator (M). RUY = correlation (r) between an unmeasured confounder (U) and the outcome (Y). Values in the blue space represent partial correlations for an unmeasured confounder that would reduce the observed indirect effect of parent-child dysfunctional interaction at 15 months to zero. Black dots represent observed partial correlations between potential measured confounders (outcomes measured in earlier waves of MIHOPE that were not part of this mediation model) and parent-child dysfunctional interaction at 15 months and kindergarten.

Imai method, which can be implemented in the CMA framework.⁹⁸ Therefore, the LOVE plot method was used to test for the plausibility of unmeasured confounders for the primary path model and the Imai method was conducted to test for the plausibility of unmeasured confounders on the secondary, CMA model.

As described above, the LOVE plot shows the partial correlation between an unmeasured confounder (C) and the mediator (M), and the partial correlation between the unmeasured confounder (C) and the outcome (Y) that would be needed to reduce the observed indirect effect to zero. These plots can be used to determine the plausibility that there are unmea-

98. MacKinnon and Pirlott (2015); Mauro (1990); Cox, Kisbu-Sakarya, Miočević, and MacKinnon (2013); Imai and Yamamoto (2013).

sured confounders given the partial correlations between $C-M$ and $C-Y$ needed to reduce the observed mediated effect to zero.⁹⁹ (Small partial correlations would indicate that there could be plausible unmeasured confounders; large partial correlations would indicate that there are unlikely to be plausible unmeasured confounders.) There are no established benchmarks typically applied to the correlations, but, since correlations are frequently reported in the literature, the typical magnitudes of associations that have been reported can be used to assess the degree to which it is plausible that such a large confounder could exist.

Like the LOVE plot method, the Imai sensitivity test was also used to assess how large a confounder effect on the $M-Y$ relationship would need to be to invalidate conclusions about mediation.¹⁰⁰ The Imai method does this by systematically increasing the correlation between the error terms in the model predicting the mediator and in the model predicting the outcome (expressed as ρ). The goal is to find how large the correlation or ρ would need to be to result in the indirect effect being reduced to zero. While there are no established benchmarks for what a “high” or “low” value of ρ is, there have been calls to report this coefficient so that comparisons can be made across studies.¹⁰¹

Cognitive flexibility. There were no mediators with statistically significant indirect effects, so no tests for unmeasured confounders were conducted.

Parent-child dysfunctional interaction. The only statistically significant indirect effect for parent-child dysfunctional interaction in the path analysis was the same measure from the 15-month follow-up. The same LOVE plot shown in Appendix Figure J.2 was used to determine the plausibility of an unmeasured confounder. As stated previously, the blue area shows all values of a $C-M$ and $C-Y$ partial correlation that would lead to the observed indirect effect being zero if C was controlled for in the model. This shows that a potential unmeasured confounder would need to have a partial correlation with parent-child dysfunctional interaction at both 15 months and kindergarten of 0.30 or higher to cause the observed indirect effect to be reduced to zero. This is a relatively large but not impossibly large partial correlation, so there is a chance that there could be an unmeasured confounder that would bias these findings.

The Imai test was conducted for the two indirect effects found in the CMA model—parent-child dysfunctional interaction at 15-months and mastery at 15-months. The ρ values that would be needed to reduce these indirect effects to zero are 0.29 and 0.07, respectively. As mentioned previously, there are no established benchmarks for a “high” or “low” ρ value; they are reported here to aid in the development of such benchmarks in the future.

Food insecurity. There were no mediators with statistically significant indirect effects, so no tests for measured confounders were conducted.

99. MacKinnon and Pirlott (2015); Mauro (1990); Cox, Kisbu-Sakarya, Miočević, and MacKinnon (2013).

100. Imai and Yamamoto (2013).

101. Chi et al. (2022).

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