

Analysis Plan for the Mother and Infant Home Visiting Program Evaluation (MIHOPE) Kindergarten Follow-up



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Overview

This document describes plans for the analysis of the Mother and Infant Home Visiting Program Evaluation (MIHOPE) follow-up data collected when participating children were in kindergarten or first grade.

The overarching goal of 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, 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).

To examine the potential long-term effects of the MIECHV Program on children and families, a follow-up when children were in kindergarten (approximately five to six years after women enrolled in the MIHOPE randomized controlled trial) was planned. This time point was chosen in part 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. Because of the broad range of outcomes that home visiting aims to affect, the study planned to collect a wide range of data on child and family well-being.

This analysis plan begins by describing the intended kindergarten design and how the study team adjusted those plans in response to the COVID-19 pandemic. Originally, data collection was planned to occur 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). Due to the pandemic, data collection was 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 those in Cohort 4 were slated to attend kindergarten. In light of the ongoing pandemic at that time, the study team adapted the kindergarten data collection so that all in-home assessments for Cohorts 3 and 4 could be conducted virtually. The study team also designed and implemented a brief web survey and qualitative interviews from late 2020 to early 2021 to understand how MIHOPE families were experiencing the pandemic and gather information to contextualize the study’s kindergarten findings.

Next, the analysis plan describes the study team’s plans for the kindergarten analyses, which include conducting impact and mediation analyses. For the impact analyses, the study team will examine and report on the estimated effects of home visiting on 66 child and family outcomes in five outcome areas. To focus the impact analyses and aid in the interpretation of the results given the large number of individual outcomes, the study team will answer several topical research questions using omnibus tests to examine the pattern of effects across the outcomes that answer each research question. The prespecified research questions are:

- Did home visiting affect outcomes that could be improved through direct interactions between parents and home visitors?
- 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 language, early math, and cognitive skills?
- Did home visiting affect parent-child interactions?
- Did home visiting affect aggression, conflict, violence, and maltreatment?
- Did home visiting affect material hardship, employment, education, and income?
- Did home visiting affect maternal mental and behavioral health?

The study team will draw on the answers to these multiple questions in interpreting the effects of home visiting at the kindergarten follow-up.

The study team will also conduct exploratory analyses to determine whether effects differ across prespecified subgroups of families, defined using family characteristics.

To shed light on pathways or mechanisms that might explain how home visiting influenced kindergarten outcomes, the study team will conduct mediation analyses that estimate the hypothetical mechanisms or pathways to individual statistically significant kindergarten outcomes of interest, using the information about children’s development and families’ well-being measured at earlier waves of MIHOPE. Though the results will not allow for causal interpretation of the estimates, these exploratory analyses can help identify intermediate outcomes from earlier waves that are most likely to have contributed to impacts on outcomes at the kindergarten follow-up.

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Background on MIHOPE

Overview of the MIHOPE Design

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, 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).

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 to a program group, whose members could receive services from a MIECHV-funded local home visiting program, or to a control group, whose members received information about other appropriate services in the community.

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). When the programs were recruited for MIHOPE, 19 were implementing the Early Head Start—Home-based option home visiting model, 26 were implementing Healthy Families America, 22 were implementing Nurse-Family Partnership, and 21 were implementing the Parents as Teachers model.¹

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 had to be interested in receiving home visiting services. They also had to not already be receiving home visiting services from a participating local program and had to meet the relevant local program eligibility criteria.

Effects Found in Earlier MIHOPE Waves

MIHOPE first estimated the effects of MIECHV-funded early childhood home visiting programs on family and child outcomes around the time the study child was 15 months of age.² This data collection occurred between May 2014 and June 2017. Results included 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)

¹For information about state and site selection, see Michalopoulos et al. (2019).

²Michalopoulos et al. (2019) describes the results of the impact analysis and analysis of impact variation from the first phase of MIHOPE.

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.³

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, and child behavior problems.⁴ 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.⁵

To ensure that the study was in a strong position to conduct later data collection with families, the MIHOPE team asked families for updated contact information when children were about 2.5 and 3.5 years of age so that they could be contacted in the future. Although the primary purpose of checking in with families was to 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. Because of the brevity of the survey, the study team could measure only a limited set of outcomes, could not comprehensively assess any of the outcome areas examined, and could not assess all the outcome areas specified in the MIECHV legislation.

Kindergarten Design and Context

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 are participating in MIHOPE to examine the potential long-term effects, including cost benefits, of the MIECHV Program on children and families.⁶ 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.⁷

A follow-up data collection when children were in kindergarten was planned because measuring children's cognitive, behavioral, self-regulatory, and social-emotional skills at the

³SEC. 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.

⁴To 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.

⁵For more information, see Michalopoulos et al. (2019).

⁶See Michalopoulos, Faucetta, Warren, and Mitchell (2017).

⁷For more information, see Faucetta et al. (2020).

outset of formal schooling could provide important data on the longer-term 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.⁸ A follow-up in the children’s kindergarten year allows the study team to measure these key mediators to permit a future examination of the mechanisms or processes by which home visiting may predict longer-term outcomes. 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, and this was not something that could be measured during previous MIHOPE follow-ups.⁹

The next sections describe the data sources the study team obtained and the planned timing of data collection. They also describe how the COVID-19 pandemic affected the MIHOPE kindergarten follow-up, including new data collection efforts the team added to the study to understand families’ experiences of the pandemic, changes to the timing of data collection, adaptations the team made to how the kindergarten data were collected, and the study team’s plans to incorporate the effects of the pandemic in interpreting the kindergarten findings.

Kindergarten 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. The check-ins only involved administering brief surveys with caregivers.

The data sources the study team collected are listed below; the *Impact Analysis* section introduces the measures the team will create using these data sources.¹⁰

- A structured interview with the children’s mothers to measure a broad set of constructs that are mostly not available from other data sources¹¹
- 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

⁸Duncan et al. (2007); Eisenberg, Valiente, and Eggum (2010); Portilla et al. (2014).

⁹SEC. 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.

¹⁰Two additional data sources collected information about families’ experiences during the COVID-19 pandemic and are described in *The Study’s Response to the COVID-19 Pandemic* section.

¹¹In cases where the mother was not available (for example, because she no longer has 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.

- 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
- A direct assessment of mothers' working memory conducted by trained field interviewers
- A teacher survey to measure children's social and emotional development, approaches to learning, disciplinary incidents, receipt of special services, and school attendance
- 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 child welfare records
- School records, from state and local education agencies

Planned Timing of Kindergarten Data Collection

The kindergarten follow-up was slated to occur approximately five to seven years after women enrolled in MIHOPE. The children in the MIHOPE sample attended kindergarten over four school years, given that random assignment of families into the sample occurred from October 2012 to October 2015. As such, approximately 600 children in the sample attended kindergarten in the 2018-2019 school year (Cohort 1), about 2,100 children in the 2019-2020 school year (Cohort 2), about 1,200 children in the 2020-2021 school year (Cohort 3), and about 150 children in the 2021-2022 school year (Cohort 4). Data collection was slated to occur during these four school years.

Kindergarten data collection for Cohort 1 was fielded from February 2019 to May 2019, and data collection for Cohort 2 was fielded from October 2019 to March 2020.

The Study's Response 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 effects of the COVID-19 pandemic. The study team halted outreach to the few Cohort 2 families who were still being invited to participate in data collection as public health emergency measures were put in place.

Cohort 3 data collection was slated to occur during the 2020-2021 school year. However, the study team decided not to move forward with obtaining kindergarten follow-up data from families during that school year because conducting in-person data collection at that point in the pandemic presented great risk to families' and data collectors' health, given the lack of vaccine availability in the United States at the time. Many locales were still under public health stay-at-home ordinances when the study team would have been planning the logistics and hiring to

launch Cohort 3's fielding effort, and it was also unclear whether and how schools would reopen for the 2020-2021 school year.¹²

COVID-19 Focused Data Collection

Rather than collect kindergarten follow-up data during the 2020-2021 school year, the study team implemented new virtual data collection efforts to enhance understanding of how MIHOPE families were experiencing the pandemic. These efforts were undertaken in order 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 100 families who responded to the web survey between October 2020 and January 2021.

The web survey gathered 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. As a supplemental impact analysis, program and control group levels and differences using the web survey measures will be examined to contextualize the kindergarten findings and better understand whether the pandemic affected these groups differently.

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 this 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.

Resuming Kindergarten Data Collection

States and local school districts implemented a heterogeneous set of reopening plans in the 2020-2021 school year, which made for a highly disrupted kindergarten year for young children across the nation. These disruptions to the typical kindergarten experience included attending remote or hybrid 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.¹³

Schools largely reopened for in-person schooling across the country for the 2021-2022 school year. This presented the opportunity to still collect data from the children in Cohort 3 at

¹²Burbio (2022).

¹³Dee, Huffaker, Phillips, and Sagara (2021).

their transition to formal schooling, since first grade was the first full year of consistent, in-person schooling for the children. In consultation with child development experts, the study team determined that it was still developmentally appropriate to collect the study's child development measures when the children were in first grade. The 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.

Thus, the kindergarten follow-up resumed data collection during the 2021-2022 school year while children in Cohort 3 were slated to attend first grade and those in Cohort 4 were slated to attend kindergarten, in order to collect data at this point of transition into formal schooling. However, the pandemic continued to be a factor as the study team prepared to resume data collection during the 2021-2022 school year.

Adaptations to Kindergarten Data Collection

As the study team and project officers from ACF's Office of Planning, Research, and Evaluation (OPRE) began preparing to resume data collection during the 2021-2022 school year, they remained concerned about conducting a large-scale in-person data collection effort, which would require air travel and in-person contact in families' homes with the portion of the population that was not age-eligible for vaccines.¹⁴ 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 that was conducted with children and their mothers.

Following the completion of the pilot and the continued lack of availability of vaccines for the children in the MIHOPE sample, the team decided to move forward with conducting all in-home assessments virtually for Cohorts 3 and 4. 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 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.¹⁵ Early evidence demonstrated that it was

¹⁴Vaccines were not authorized for emergency use with children ages 5 to 11 until October 2021.

¹⁵Data Recognition Corporation (2022); Riverside Insights (n.d.).

possible to conduct tasks like the Woodcock-Johnson IV Cognitive and Achievement Tests in a virtual manner.¹⁶

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 touchscreen 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 task.* 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).

¹⁶Wright (2018).

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 or virtual class in the 2021-2022 school year.

Acknowledging the COVID-19 Pandemic in Interpreting Kindergarten Findings

Because the pandemic began in the midst of kindergarten data collection, the study team will analyze data separately for the two-thirds of the sample for whom the team obtained kindergarten data before the pandemic (Cohorts 1 and 2) and for the third of the sample for whom they obtained follow-up data during the pandemic (Cohorts 3 and 4), in addition to analyzing data together for all cohorts.

In interpreting the results of the kindergarten analyses, particularly for the portion of the sample for whom follow-up data was obtained during the pandemic, the study team will draw on the contextual information that was obtained from surveys and interviews with MIHOPE families about their experience of the pandemic, as well as information reported nationally and from other studies. For example, the study team will try to contextualize findings in light of the wide variability in school reopenings and disruptions in the 2020-21 and 2021-22 school years, the large drops in enrollment in kindergarten in 2020-21, and national trends in reading and math scores during the kindergarten and first grade years of children affected by the pandemic.¹⁷ The team can also contextualize findings in light of the implications of the pandemic for mothers, including changes in employment status due to school closures and lack of childcare, drops in income and food security, rises in stress, poor mental health, substance use, and government responses, such as changes in public benefits.¹⁸

Kindergarten Analyses

The study team will conduct an impact analysis to assess the effects of home visiting programs on child and family outcomes, and a mediation analysis to analyze the pathways through which home visiting programs produce effects on these outcomes. The next sections describe the team’s plans for these analyses.

Impact Analysis

This section introduces the organizational framework for the 66 outcomes included in the impact analysis and discusses the outcomes included in each outcome area and sub-area. The study team will present estimated effects for each of these individual outcomes in the kindergarten report. This section also discusses how the study team will focus the impact analyses, analytical frameworks the team will use, and exploratory subgroup analyses based on family characteristics and home visiting model.

¹⁷Burbio (2022); Dee et al. (2021); Dorn, Hancock, Sarakatsannis, and Viruleg (2021); Jacobsen (2022).

¹⁸Ranji, Frederiksen, Salganicoff, and Long (2021); Garcia and Cowan (2022). Chen, Byrne, and Velez (2022); Kalil, Mayer, and Shah (2020); Patrick et al. (2020); Lamar, Forbes, Speciale, and Donovan (2021).

Organizational Framework for Outcomes

The outcomes of interest for which effects will be estimated in the kindergarten follow-up are organized across five outcome areas. Each outcome area is further organized into conceptually coherent sub-areas. The outcome areas and sub-areas are shown in Table 1. The next section describes how outcomes are organized into these areas and sub-areas, and descriptions of the outcomes are included in Appendix A.

Table 1

Kindergarten Outcome Areas and Sub-Areas

Outcome area	Sub-area
Child functioning	<ul style="list-style-type: none"> Social skills Behavior problems Emotional and behavioral self-regulation Cognitive skills Language development Mathematics development Behavior toward parent during semi-structured task Quality of play during semi-structured task
Parenting	<ul style="list-style-type: none"> Parent-child relationship Behavior toward child during semi-structured task Aggression toward child Child maltreatment Parental support for learning and development
Maternal well-being	<ul style="list-style-type: none"> Maternal coping strategies Parental distress Maternal depressive symptoms Maternal substance use
Family conflict and violence	<ul style="list-style-type: none"> Family conflict Intimate partner violence
Family economic self-sufficiency	<ul style="list-style-type: none"> Material hardship Public assistance receipt Employment and income

*Outcomes Included in Impact Analysis*¹⁹

Child Functioning

The improvements in maternal and family functioning outcomes found in earlier waves of MIHOPE suggest that home visiting could result in program impacts on children’s functioning in kindergarten in a variety of sub-areas. The last comprehensive assessment of children’s development and well-being in MIHOPE occurred when the children were approximately 15 months of age, which was likely too early to see the effects of home visiting on children’s functioning.²⁰ MIHOPE also obtained a snapshot of children’s early academic skills, fine motor skills, language expression, and behavioral self-regulation via surveys with caregivers when the children were approximately 3.5 years old. However, this was limited in scope given the brevity of the phone survey. Thus, the kindergarten data collection effort was designed to comprehensively measure children’s social and emotional, behavioral, cognitive, language, and mathematics skills at the outset of formal schooling to provide important data on the intermediate effects of home visiting.

Because the kindergarten analysis will examine a wide breadth of child functioning outcomes, the study team organized these outcomes in the following eight sub-areas: *social skills, behavior problems, emotional and behavioral self-regulation, cognitive skills, language development, mathematics development, behavior toward parent during semi-structured task, and quality of play during semi-structured task* (see Table 2).²¹

Table 2

Child Functioning

Outcome	Home Context	School Context
<u>Social skills</u>		
Engagement ^{b, c}	✓	✓
Cooperation ^c		✓
Assertive social skills ^c		✓
<u>Behavior problems</u>		
Externalizing behaviors ^{b, c}	✓	✓
Internalizing behaviors ^{b, c}	✓	✓
<u>Emotional and behavioral self-regulation</u>		
Emotional self-control ^{b, c}	✓	✓
Hyperactivity/inattention ^{b, c}	✓	✓
Attention/impulse control ^d	✓	
Task orientation ^c		✓
Frustration tolerance ^c		✓

¹⁹Constructs that were collected in the kindergarten follow-up data collection but are not included in the impact analysis are discussed in Appendix B.

²⁰Michalopoulos et al. (2019).

²¹Tables 2-6 show the data sources that will be used to measure outcomes. Appendix C provides information about administrative data availability for state and local administrative data sources and sampling strategies used in the kindergarten caregiver survey design.

Table 2

Child Functioning

Outcome	Home Context	School Context
<u>Cognitive skills</u>		
Inhibitory control ^a	✓	
Cognitive flexibility ^a	✓	
Short-term memory ^a	✓	
<u>Language development</u>		
Vocabulary knowledge ^a	✓	
<u>Mathematics development</u>		
Early numeracy and math skills ^a	✓	
<u>Behavior towards parent during semi-structured task</u>		
Child engagement of parent ^a	✓	
Child negativity toward parent ^a	✓	
<u>Quality of play during semi-structured task</u>		
Child quality of play ^a	✓	

Data source: a = direct assessment; b = caregiver survey; c = teacher survey; d = observer rating during direct assessment

Social Skills

Children’s social skills provide a critical foundation for lifelong development and learning. These skills represent learned behaviors that promote positive interactions while simultaneously discouraging negative interactions when applied to appropriate social situations. The developmental literature indicates that children’s social competence is associated with children’s academic competence in school.²² The kindergarten follow-up will examine children’s *engagement*, *cooperation*, and *assertive social skills*.

Behavior Problems

Having behavior problems in early childhood is a risk factor for mental health issues and academic difficulties throughout childhood and into adulthood.²³ The kindergarten follow-up will examine impacts on children’s problem behaviors, specifically *externalizing behaviors* (e.g., outward expressions of aggression, hostility, and oppositional behavior) and *internalizing behaviors* (e.g., social withdrawal, depression, loneliness).

Emotional and Behavioral Self-Regulation

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,

²²Cantor et al. (2019); Domitrovich, Durlak, Staley, and Weissberg (2017); Portilla et al. (2014).

²³Hinshaw (1992); Reef et al. (2011); Masten et al. (2005).

and overall academic learning.²⁴ The kindergarten follow-up will examine impacts on children's *self-control, hyperactivity/inattention, attention/impulse control, task orientation, and frustration tolerance*.

Cognitive Skills

Executive functions (EF) are a higher-order set of cognitive skills that include inhibitory control, cognitive flexibility, and working memory.²⁵ These skills enable children to control their attention, behavior, and emotions. Numerous studies have linked children's performance on EF tasks to various language and literacy skills, math skills, learning behaviors, and school engagement.²⁶ Using performance-based tasks, the kindergarten follow-up will examine impacts on children's *inhibitory control and cognitive flexibility*, as well as a closely related cognitive skill, *short-term memory*.

Language Development

Children with strong language skills are prepared to be successful learners in school. In the context of early schooling, it is critical for children to comprehend the words and vocabulary that are spoken to them. The kindergarten follow-up will examine impacts on children's *vocabulary knowledge*.

Mathematics Development

Mathematics skills develop in the preschool years and are important as children transition to elementary school. These skills refer to children's understanding of numbers and quantities, their relationships, and operations (for example, addition and subtraction). Mathematics skills also include learning shapes and their structure, reasoning, measurement, classifications, and patterns. The kindergarten follow-up will examine impacts on children's *early numeracy and mathematics skills*.

Behavior Toward Parent During Semi-Structured Task

Children's behavior toward their mother were rated using the Three-Bags Task, a semi-structured play task involving a book and toys. The kindergarten follow-up will examine impacts on *child engagement of parent and child negativity toward parent*.

Quality of Play During Semi-Structured Task

Children's quality of play with objects was rated using the Three-Bags Task, a semi-structured play task involving a book and toys. The kindergarten follow-up will examine impacts on *child quality of play*.

²⁴Blair (2016).

²⁵Miyake et al. (2000).

²⁶Blair and Razza (2007); Gathercole, Alloway, Willis, and Adams (2006); Bull and Scerif (2001); Anderson (2007); Blair and Peters (2003); Obradović (2010).

Box 1

Home Versus School Context

Child functioning outcomes were measured in both home and school contexts and will be examined separately. Parents and teachers provide unique 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 certain children they are exposed to. Parents likely compare their children's behaviors to the children they know, which may vary across communities and cultures. Similarly, teachers likely assess children's functioning relative to their classmates rather than using national norms. Alternatively, teacher ratings may suffer from implicit biases about developmentally appropriate behavior based on the child's race or ethnicity.* Table 2 depicts which outcomes were collected from the home versus school context.

The COVID-19 pandemic provides additional rationale for examining effects for the home and school context separately. While approximately two-thirds of the sample had the follow-up data collected prior to the pandemic, the other third had data collected during the pandemic. Emerging evidence is highlighting the challenges young children experienced at home during the pandemic (for example, an increase in mental health problems), as well as adjusting back at school (for example, an increase in behavior problems and violence).† Though data was collected from teachers for children who physically spent time in their classroom, public health safety measures implemented by some school districts during the pandemic (for example, social distancing, masking, lunch time limitations on speaking, etc.) may mean that some children were not able to fully display their whole selves (emotionally, socially, cognitively, or academically) to teachers in school. Indeed, the pandemic is an ongoing event that has impacted everyone, not just children. It remains unclear at this time if and how stressors affected teachers and parents differentially, and how that may affect how they rate children's behaviors, compared to how they would have rated them before the pandemic.

NOTES: *Neitzel (2018); Quinn and Stewart (2019); Staats (2014).

†Leeb et al. (2020); Yard et al. (2021); Bryant, Oo, and Damian (2020); Listernick and Badawy (2021); Sawchuk (2021).

Parenting

Home visiting aims to affect parenting practices and the development of nurturing and supportive relationships between parents and their children. Close relationships, competent care, and cognitive stimulation provide young children with the foundation for healthy child development. The study team organized outcomes in this outcome area in the following five sub-areas: *parent-child relationship*, *behavior toward child during semi-structured task*, *aggression toward child*, *child maltreatment*, and *parental support for learning and development* (see Table 3).

Table 3
Parenting

Outcome
<u>Parent-child relationship</u>
Parental warmth ^a
Parent-child dysfunctional interaction ^b
<u>Behavior toward child during semi-structured task</u>
Parental sensitivity ^c
Parental positive regard ^c
Parental stimulation of cognitive development ^c
Parental intrusiveness ^c
Parental detachment ^c
Parental negative regard ^c
<u>Aggression toward child</u>
Psychological aggression ^b
Physical aggression ^b
<u>Child maltreatment</u>
Report of abuse ^d
Child hospitalizations for injuries and ingestions ^e
Report of neglect ^d
<u>Parental support for learning and development</u>
Frequency of reading ^b
Average amount of reading to child per day in a typical week ^b
Number of children's books in the home ^b
Literacy activities in the home ^b
Learning activities in the home ^b
Percent of days absent from school ^f

Data source: a = observer rating during assessment; b = caregiver survey; c = direct assessment; d = child welfare records; e = Medicaid records; f = school records

Parent-Child Relationship

Constructs related to the parent-child relationship have rarely been examined in prior home visiting studies that occurred at age 5 or later, though these parent behaviors are direct targets of home visiting. The kindergarten follow-up will examine impacts on *parental warmth* and *parent-child dysfunctional interaction*.

Behavior Toward Child During Semi-Structured Task

Mothers' behavior toward her child was rated using the Three-Bags Task, a semi-structured play task involving a book and toys. The kindergarten follow-up will examine impacts on *parental sensitivity*, *parental positive regard*, *parental stimulation of cognitive development*, *parental intrusiveness*, *parental detachment*, and *parental negative regard*.

Aggression Toward Child

The kindergarten follow-up will examine the extent to which parents exhibit negative behaviors when they experience conflict or hostility toward their child. The kindergarten follow-up will examine impacts on *psychological aggression* and *physical aggression*.

Child Maltreatment

Child maltreatment encompasses intentional words and acts, failures to provide for a child's needs, and failures to protect a child that result in harm, as well as the potential for and threat of harm, to a child.²⁷ The kindergarten follow-up will examine impacts on *report of abuse*, *child hospitalizations for injuries and ingestions*, and *report of neglect*.

Parental Support for Learning and Development

The kindergarten follow-up will examine whether home visiting improves parenting practices supportive of early learning, including environmental factors that are most influential for literacy growth and engaging in activities that have been shown to have positive effects on children's later cognitive development and academic achievement.²⁸ The kindergarten follow-up will examine impacts on *frequency of reading*, *average amount of reading to child per day in a typical week*, *number of children's books in the home*, *literacy activities in the home*, *learning activities in the home*, and *percent of days absent from school*.

Maternal Well-Being

Maternal well-being can affect mothers' interactions and relationships with their child and their ability to provide a supportive and safe environment for their child. The study team organized outcomes in this outcome area in the following four sub-areas: *maternal coping strategies*, *parental distress*, *maternal depressive symptoms*, and *maternal substance use* (see Table 4).

²⁷Leeb et al. (2008).

²⁸For findings on children's cognitive development, see Fiorini and Keane (2014) and Kalil and Mayer (2016); for findings on academic achievement as children age, see Bodovski and Farkas (2008).

Table 4

Maternal Well-Being

Outcome
<u>Maternal coping strategies</u>
Mastery ^a
Perceived social support ^a
Resource mobilization ^a
<u>Parental distress</u>
Parental distress ^a
<u>Maternal depressive symptoms</u>
Exhibits depressive symptoms ^a
<u>Maternal substance use</u>
Used illicit drugs ^a
Excessive drinking ^a

Data source: a = caregiver survey

Maternal Coping Strategies

The study team measured the extent to which mothers feel control over their lives, have tangible, emotional, and informational support, and are able and feel empowered to find resources they or their families might need. The kindergarten follow-up will examine impacts on mothers' sense of *mastery*, *perceived social support*, and *resource mobilization*—their ability to use resources in their community.

Parental Distress

Parental distress reflects the level of distress a parent experiences in their role as a parent as a function of personal factors that are directly related to parenting: parenting competence, restrictions placed on other life roles, conflict with child's other parent, lack of social support, and depression. The kindergarten follow-up will examine impacts on *parental distress*.

Maternal Depressive Symptoms

Maternal depression has the potential to negatively impact children's cognitive and language development, as depression can interfere with mothers' ability to respond sensitively and consistently over time.²⁹ The kindergarten follow-up will examine impacts on *maternal depressive symptoms*.

Maternal Substance Use

Substance use, including excessive drinking and use of illicit drugs, has the potential to affect mothers' ability to contribute to creating supportive and safe environments for their child. The kindergarten follow-up will examine impacts on *excessive drinking* and *using illicit drugs*.

²⁹Knitzer, Theberge, and Johnson (2008); Sohr-Preston and Scaramella (2006).

Family Conflict and Violence

The study team measured fighting and other behaviors related to conflict among family members, as well as physical violence between adult partners and women's experience with battering. The study team organized outcomes in this outcome area in the following two sub-areas: *family conflict* and *intimate partner violence* (see Table 5).

Table 5

Family Conflict and Violence

Outcome
<u>Family conflict</u> Family conflict ^a
<u>Intimate partner violence</u> Maternal experience with physical violence ^a Maternal perpetration of physical violence ^a Women's experience with battering ^a
Data source: a = caregiver survey

Family Conflict

The study team measured the amount of openly expressed anger and lack of cohesion among family members. The kindergarten follow-up will examine impacts on *family conflict*.

Intimate Partner Violence

Intimate partner violence encompasses acts of physical violence, such as hitting or grabbing, and battering, which is a "syndrome of control and increasing entrapment that accompanies the use of physical force in intimate relationships."³⁰ The kindergarten follow-up will examine impacts on *physical violence* and *experience with battering* among mothers with a partner.

Family Economic Self-Sufficiency

The study team organized outcomes in this outcome area in the following three sub-areas: *material hardship*, *employment and income*, and *public assistance receipt* (see Table 6).

³⁰Smith, Earp, and DeVellis (1995); Stark and Flitcraft (1991).

Table 6

Family Economic Self-Sufficiency

Outcome

Material hardship
Food insecurity^a
Material hardship^a
Number of moves in past year^a

Employment and income
Quarters employed in past year^c
Earnings in past year^c
Income^a
Increase in education level since study entry^a
Among those without high school diploma at baseline, percentage with high school diploma^a

Public assistance receipt
TANF receipt^a
SNAP receipt^a
WIC receipt^a
Disability benefit receipt^a
Medicaid receipt^b

Data source: a = caregiver survey; b = Medicaid records; c = National Directory of New Hires records

Material Hardship

The kindergarten follow-up will examine impacts on measures of material hardship, food insecurity, and number of moves in the past year as these are indicators of a family's degree of economic security—including the ability to pay rent or pay for utilities, pay for health care, or afford sufficient food—and of a family's connection to services and benefits.

Employment and Income

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. The kindergarten follow-up will examine impacts on *quarters employed in the past year*, *earnings in the past year*, *income*, *increase in education level since study entry*, and *percentage with high school diploma (among those without a high school diploma at study entry)*.

Public Assistance Receipt

Receiving public assistance may be a positive outcome for families whose incomes make them eligible for these supports, while at the same time, not receiving public assistance may be a positive outcome for families whose incomes have risen past the income eligibility thresholds for these supports. The kindergarten follow-up will examine impacts on *TANF receipt*, *SNAP receipt*, *WIC receipt*, *disability benefit receipt*, and *Medicaid receipt*, but will acknowledge this ambiguity about the direction of effects.

Focusing the Impact Analysis

Early childhood home visiting programs are designed to affect a wide range of outcome areas, and prior studies have found effects in several areas, which vary depending on which national model was being evaluated. Because of the wide range of outcomes of interest, MIHOPE collected a wide range of data for its kindergarten follow-up, and the study team will assess impacts on 66 outcomes and will show estimated effects for these individual outcomes in the kindergarten report.

The study team considered how best to focus the impact analyses and aid in the interpretation of the results, rather than examining individual effects for so many outcomes without a framework or structure to focus or organize the findings. The team decided to answer several topical research questions, using omnibus tests to interpret the pattern of effects across the outcomes that answer each research question.³¹ The study team will draw on the answers to these multiple questions in interpreting the effects of home visiting.

While the study team prespecified several topical research questions, they may decide to examine additional research questions after the analysis plan is finalized or after results are analyzed.³² The prespecified research questions are shown in Table 7, along with the rationale for each question's inclusion, and the sub-areas that would be used to answer each question. As the table shows, the outcomes used to answer these questions are drawn from sub-areas across and within outcome areas, and some sub-areas are used to answer more than one research question.³³ The proposed research questions cover all sub-areas included in the impact analysis, with the exception of public assistance receipt and quality of play during semi-structured task.³⁴

³¹In earlier MIHOPE follow-ups, the study team has focused its analyses by identifying a small number of outcomes as confirmatory and conducting additional tests to understand the pattern of effects across the confirmatory outcomes (in the 15-month analysis) or across outcomes within each outcome area (the 2.5- and 3.5-year analyses). (The study team plans to use omnibus tests based on Devin Caughey, Allan Dafoe, and Jason Seawright, "Nonparametric Combination (NPC): A Framework for Testing Elaborate Theories." *Journal of Politics* 79, 2 2017: 688-701 to characterize patterns by accounting for the magnitude of estimated effects; they have used this approach in earlier MIHOPE analyses, see Michalopoulos et al., 2019 and Faucetta et al., 2023.) Appendix D describes the process the study team used to make decisions about how to focus the kindergarten analysis.

³²In the kindergarten report, questions will be identified as prespecified or not prespecified.

³³Because outcomes are organized into conceptually coherent sub-areas, research questions will be organized based on sub-area, rather than choosing individual outcomes that can contribute to answering research questions.

³⁴The study team will exclude public assistance receipt outcomes from all omnibus tests conducted because the direction of effects is not clear (as in, receipt may be positive or negative, depending on families' circumstances). Quality of play during semi-structured task will also be 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 currently proposed research questions. Further, it is measured via only one subscale of the Three-Bags Task that focuses on the child's play with objects. Therefore, it will not be elevated to its own research question.

Table 7
Prespecified Topical Research Questions

Research question	Rationale	Sub-area(s)
Did home visiting affect parenting behavior and outcomes that are directly targeted by strategies and information that the home visitor provides to the mother?	Home visitors work directly with mothers on some areas, while improvements in other areas may be dependent on connections to other services	Maternal coping strategies Parent-child relationship Behavior toward child during semi-structured task Parental support for learning and development Parental distress Aggression towards child
Did home visiting affect parent-child interactions?	Parent-child interactions are a core aspect of home visiting services; program logic models emphasize outcomes captured in these sub-areas	Parent-child relationship Behavior toward child during semi-structured task Behavior toward parent during semi-structured task Parental support for learning and development Aggression towards child
Did home visiting affect aggression, conflict, violence, and maltreatment?	Aggression effects seen at 15 months; authorizing legislation	Aggression toward child Family conflict Child maltreatment Intimate partner violence
Did home visiting affect children's social-emotional functioning in the home context?	Logic models emphasize improving children's social and self-regulatory skills and reducing behavior problems. Have the opportunity to examine how children are functioning in home settings as reported by parents and observed by assessors.	Social skills (<i>home context</i>) Behavior problems (<i>home context</i>) Emotional and behavioral self-regulation (<i>home context</i>) Behavior toward parent (<i>home context</i>)
Did home visiting affect children's social-emotional functioning in school settings?	Logic models emphasize improving children's social and self-regulatory skills and reducing behavior problems. Have the opportunity to examine how children are functioning in school settings as reported by teachers.	Social skills (<i>school context</i>) Behavior problems (<i>school context</i>) Emotional and behavioral self-regulation (<i>school context</i>)
Did home visiting affect children's language, early math, and cognitive skills?	Logic models and authorizing legislation emphasize school readiness and more academically-focused outcomes; these outcomes were collected directly from children in their homes.	Language development (<i>home context</i>) Mathematics development (<i>home context</i>) Cognitive skills (<i>home context</i>)
Did home visiting affect material hardship, employment, education, and income?	Logic models; authorizing legislation; priority accorded by models	Material hardship Employment and income

Table 7

Prespecified Topical Research Questions

Research question	Rationale	Sub-area(s)
Did home visiting affect maternal mental and behavioral health?	Effects on depression at 15 months	Maternal substance use Parental distress Maternal depressive symptoms Maternal coping strategies

Subgroup Analyses—Family Characteristics

As in the MIHOPE 15-month impact analysis, the study team will analyze whether effects differ across prespecified subgroups of families, defined using family characteristics measured when women entered the study. The focus of the subgroup impact analyses will be tests of whether estimated subgroup impacts within a construct are statistically different from each other for particular outcomes—in other words, of whether the estimated effects are larger or smaller among any of these subgroups. For continuity with earlier MIHOPE analyses, the study team will examine the same seven subgroups that were used in the MIHOPE 15-month analyses. As described in Michalopoulos et al. (2019), these subgroups 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 seven subgroups are:

1. gestational age (a measure with three categories: not pregnant [since some women had already given birth when they enrolled in MIHOPE], up to 28 weeks pregnant, and more than 28 weeks pregnant);
2. parity (whether the woman had children before the pregnancy or newborn with which she entered the study);
3. the mother’s race and ethnicity;
4. the presence of intimate partner violence;
5. the mother’s level of emotional functioning;³⁵
6. the mother’s psychological resources;³⁶ and

³⁵The three maternal functioning subgroup categories are defined as “high maternal functioning,” consisting of mothers who did not exhibit depressive symptoms, did not exhibit relationship anxiety, and did not exhibit relationship avoidance, “moderate maternal functioning,” consisting of mothers who exhibited one of these characteristics, and “low maternal functioning,” consisting of mothers who exhibited two or three of these characteristics.

³⁶The 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. It is based on a composite of (1) mental health, (2)

7. demographic characteristics of mothers that have been associated with higher risk of negative outcomes for them 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 study team also plans to add a subgroup, drawing on the information about MIHOPE mothers' adverse childhood experiences (ACEs) that was gathered on the kindergarten caregiver survey. Given research that shows that the risk for a host of poor health and well-being outcomes increases as the number of adverse childhood experiences (ACEs) increases, the study team hypothesized that the effects of home visiting may differ depending on mothers' ACEs.³⁷ Because information about ACEs was collected by MIHOPE post-random assignment, reports of ACEs could have been affected by being randomly assigned to home visiting even though the actual experience of ACEs would have occurred before MIHOPE mothers entered the study.³⁸ Thus, the team will examine whether there are program-control differences in ACEs before conducting the subgroup analyses.

Analyses by Home Visiting Model

Before conducting analyses of whether effects differ across evidence-based models, the study team will assess the potential for response bias in estimating effects by evidence-based model, using the same approach used for the MIHOPE 2.5-year and 3.5-year analysis. This assessment would have two components:

- **Conceptual possibility of bias.** Applying standards from the What Works Clearinghouse to each of the four evidence-based models to understand the risk of bias.³⁹ The Clearinghouse classifies studies that use random assignment as high attrition or low attrition based on the overall survey response rate and differences in response rates between the program and control groups.⁴⁰
- **Potential for response bias in survey responses.** Conducting a response bias analysis for each evidence-based model to assess whether the program and control groups are similar among respondents for each model. This analysis may include re-estimating the 15-month findings using only respondents to the kindergarten analysis.

mastery (the extent to which a person thinks life chances are under her control), and (3) verbal abstract reasoning.

³⁷For more information, see Faucetta et al. (2020).

³⁸The exception is the portion of the sample that was younger than 18 at study entry, as the introduction to the ACEs items asks survey respondents to look back before they were 18 years of age.

³⁹What Works Clearinghouse (2022).

⁴⁰Although the What Works Clearinghouse generally classifies studies using these standards, MIHOPE applied the standards to classify the sample for each of the four evidence-based models.

The study team will review information on the potential for response bias and the statistical power of model estimates with external experts and get input on whether there are serious concerns about bias and statistical power.

Mediation Analyses

Because MIHOPE collected information about children’s development and families’ well-being across multiple developmental periods in early childhood, the study design presents an opportunity to conduct mediation analyses to shed light on the pathways or mechanisms that might explain *how* home visiting influenced individual kindergarten outcomes. The mediation analysis can use data across all earlier follow-up waves to estimate mediation models—hypothetical mechanisms or pathways—for each kindergarten outcome of interest.

These exploratory analyses will leverage the experimental design to specify mediation models that decompose a program impact (“the total effect”) into the “indirect effect” that is explained by an intervening variable, or mediator, and the “direct effect” that is explained by other factors. The results do not allow for causal interpretation of the estimates. However, decomposing the kindergarten impact estimates in this way can help identify intermediate outcomes, measured at earlier waves of MIHOPE, that are most likely to have contributed to the impacts on outcomes at the kindergarten follow-up.

Methodology

To examine the mediating pathways, the study team will use two analytical methods: path analysis and causal mediation analysis. Because the two methodologies have complementary strengths that can inform potential mechanisms, the study team will use both in the MIHOPE mediation analyses: path analysis will be the primary method for examining mediation and causal mediation analysis will be used as a secondary approach. Both approaches will include multiple mediators, but will estimate a parallel model, meaning that the specific indirect effect of each mediator is estimated, controlling for the others. This type of model will allow the examination of *which* mechanisms explain impacts on select kindergarten outcomes.

In post-hoc analyses, the study team may also use path analysis to examine sequential pathways through multiple mediators assessed at different time points. The study team will only investigate sequential indirect effects if the indirect effect of a mediator that was measured at the 2.5- or 3.5-year timepoint is statistically significant in the parallel path analysis model.

Sensitivity tests will be conducted on the primary and secondary parallel models to assess the robustness of the results. Specifically, the tests will inform the results’ sensitivity to measured and unmeasured confounders.⁴¹

Identifying Outcomes and Mediators of Interest

The kindergarten data collection effort was designed to comprehensively measure children’s social and emotional, behavioral, language, and cognitive skills at the outset of formal schooling. Thus, the study team will prioritize mediation analyses that estimate the pathways to

⁴¹Confounders are variables that cause both the mediator and the outcome.

statistically significant individual outcomes in the child functioning outcome area at this time point. Additionally, given that parenting is a proximal outcome area to child functioning and is a central focus of home visiting programs, individual outcomes in the parenting outcome area will also be prioritized.

Since home visiting programs also aim to positively affect maternal and family well-being, the study team may also conduct mediation analyses that estimate the pathways to statistically significant individual outcomes at the kindergarten follow-up in the maternal well-being, family conflict and violence, and family economic self-sufficiency outcome areas.

Mediators will be selected among the outcomes that were significantly impacted by home visiting at any of the earlier MIHOPE follow-ups (15-month, 2.5-year, and 3.5-year). The study team will be guided by theoretical frameworks, the home visiting programs' logic models, past empirical support, correlations within the MIHOPE data, and input from experts in developmental science and longitudinal designs in selecting from those constructs to include in the mediation models.

Appendix A

Measure Descriptions

This appendix describes the outcome measures that will be included in the kindergarten impact analysis. It is organized by outcome area as follows: (1) child functioning, (2) parenting, (3) maternal well-being, (4) family conflict and violence, (5) family economic self-sufficiency.

Child Functioning

Social Skills

Engagement refers to children's skills related to joining activities in progress and inviting others to join, initiating conversations, making friends, and interacting well with others. The engagement subscale is drawn from the Social Skills Improvement System (SSIS), which captures children's social and emotional skills.⁴² Both caregivers and kindergarten teachers reported on engagement to obtain perspectives of children's behavior in home and classroom settings.

Cooperation refers to children's skills related to helping others, sharing materials, and complying with rules and directions. The cooperation subscale is drawn from the Social Skills Improvement System (SSIS), which captures children's social and emotional skills.⁴³ As these behaviors are particularly relevant for classroom settings, kindergarten teachers reported on the skills as they pertain to the classroom context, such as participating appropriately in class and completing tasks without bothering others.

Assertive social skills refer to a child's interpersonal functioning and confidence in dealing with peers. The assertive social skills subscale is drawn from the Teacher-Child Rating Scale (T-CRS 2.1).⁴⁴ Kindergarten teachers reported on children's participation in class discussions, ability to express ideas willingly, ability to defend own views under group pressure, and comfort as a leader.

Behavior Problems

Externalizing problems include being verbally or physically aggressive, failing to control temper, and arguing. This subscale is drawn from the Social Skills Improvement System (SSIS).⁴⁵ Both caregivers and kindergarten teachers reported on externalizing problems to obtain perspectives of children's behavior in home and classroom settings.

Internalizing problems include feeling anxious, sad, and lonely as well as exhibiting poor self-esteem. This subscale is also drawn from the Social Skills Improvement System (SSIS).⁴⁶ Both caregivers and kindergarten teachers reported on internalizing problems to obtain perspectives of children's behavior in home and classroom settings.

⁴²Gresham and Elliott (2008).

⁴³Gresham and Elliott (2008).

⁴⁴Hightower and Perkins (2010).

⁴⁵Gresham and Elliott (2008).

⁴⁶Gresham and Elliott (2008).

Emotional and Behavioral Self-Regulation

Emotional self-control refers to whether children control their emotions and respond appropriately in conflict situations (e.g., disagreeing, teasing) and non-conflict situations (e.g., taking turns, compromising). This subscale is drawn from the Social Skills Improvement System (SSIS).⁴⁷ Both caregivers and kindergarten teachers reported on emotional self-control to obtain perspectives of children's behavior in home and classroom settings.

Hyperactivity/inattention refer to behavior characterized by moving about excessively, having impulsive reactions, and becoming easily distracted. This subscale is drawn from the Social Skills Improvement System (SSIS).⁴⁸ Both caregivers and kindergarten teachers reported on hyperactivity/inattention to obtain perspectives of children's behavior in home and classroom settings.

Attention/impulse control displayed by the child during the full child assessment period were rated by observers using the Preschool Self-Regulation Assessment (PSRA) - Assessor Report, which assesses children's emotion regulation, attention, and impulse control.⁴⁹ The PSRA - Assessor Report draws from previous work on assessors' global ratings of children's regulation.⁵⁰ Factor analysis will be used to determine which items will map onto this outcome.

Task orientation refers to a child's ability to focus on school-related tasks. Kindergarten teachers assessed whether the child functions well even with distractions, works well even without adult support, is a self-starter, and completes schoolwork. The subscale is drawn from the Teacher-Child Rating Scale (T-CRS 2.1).⁵¹

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. Kindergarten teachers will report on children's frustration tolerance. The subscale will be drawn from the Teacher-Child Rating Scale (T-CRS 2.1).⁵²

Cognitive Skills

Inhibitory control refers to a child's ability to resist distractions and temptations and suppress impulsive behaviors or thoughts.⁵³ In the Hearts & Flowers task, inhibitory control is measured by their performance on the incongruent trials. The incongruent trials require 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. The study team may also use children's reaction time to assess their inhibitory control. This outcome would calculate the average reaction time for the

⁴⁷Gresham and Elliott (2008).

⁴⁸Gresham and Elliott (2008).

⁴⁹Smith-Donald, Raver, Hayes, and Richardson (2007).

⁵⁰Roid and Miller (1997); Wakschlag et al. (2005).

⁵¹Hightower and Perkins (2010).

⁵²Hightower and Perkins (2010).

⁵³Obradović, Portilla, and Boyce (2012).

correct incongruent trials. Reaction time may also be used jointly with accuracy among children who have high accuracy.

Cognitive flexibility refers to a child's ability to shift attention or responses between competing mental states or rules.⁵⁴ In the Hearts & Flowers task, cognitive flexibility is measured by their 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 study team may also use children's reaction time to assess their cognitive flexibility. This outcome would calculate the average reaction time for the correct mixed trials. Reaction time may also be used jointly with accuracy among children who have high accuracy.

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.⁵⁵ Short-term memory was assessed using the Forward Digit Span task from the Weschler Intelligence Scale for Children (WISC-IV).⁵⁶

Language development

Vocabulary knowledge. Vocabulary knowledge was measured via direct assessment using the Picture Vocabulary test from the Woodcock Johnson IV Tests of Oral Language.⁵⁷ 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 impacts on this outcome for children whose dominant language was Spanish in kindergarten. Given the wide data collection period of children across cohorts at this timepoint in kindergarten, the study team is still investigating the most appropriate score (a raw score, standard score, and *W* score can be calculated using the test data) to use for the impact analyses of this outcome.⁵⁸ This score will be chosen before impact analyses are conducted, and the other scores will be analyzed as robustness checks.

Mathematics Development

Early numeracy and mathematics skills. The kindergarten follow-up will assess impacts on early numeracy and math skills using the Applied Problems test from the Woodcock Johnson III: Tests of Achievement.⁵⁹ This test measures children's ability to solve oral math problems (for example, "how many dogs are there in this picture?"). A Spanish version of the test is also available from the Bateria III Woodcock-Muñoz, and will assess impacts on this outcome for children's

⁵⁴Obradović, Portilla, and Boyce (2012).

⁵⁵Healy (2001).

⁵⁶Flanagan and Kaufman (2009).

⁵⁷Schrank, Mather, and McGrew (2014).

⁵⁸The Woodcock Johnson IV Tests of Oral Language produces *W* scores from raw scores to measure children's ability level, in addition to standard scores, which are normed to age or grade-level peers.

⁵⁹Woodcock, McGrew, Mather (2001).

whose dominant language was Spanish in kindergarten.⁶⁰ Given the wide data collection period of children across cohorts at this timepoint in kindergarten, the team is still investigating the most appropriate score (a raw score, standard score, and w-score can be calculated using the test data) to use for the impact analyses of this outcome.⁶¹ This score will be chosen before impact analyses are conducted, and the other scores will be analyzed as robustness checks.

Behavior Toward Parent During Semi-Structured Task

Two outcomes capture aspects of the child's behavior toward the parent during the Three-Bag Task, a semi-structured play interaction administered as part of the kindergarten in-home/virtual assessment. The parent and child were given three bags of interesting toys and asked to play with the toys in a sequence for 12 minutes. The interaction was video recorded and the child's behavior toward the parent was coded by child development researchers at the National Center for Children and Families at Teachers College, Columbia University using a strict coding protocol.⁶² This assessment was adapted for this evaluation from the Three-Bag Task coding scheme used at 14-, 24-, and 36-month follow-ups in the Early Head Start Research and Evaluation Project.⁶³

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.

Child negativity toward parent captures the degree to which the child shows anger, hostility, or dislike toward the parent during the Three-Bag Task.

Quality of Play During Semi-Structured Task

An additional outcome related to the child's behavior during the Three-Bag Task was coded to capture the quality of the child's play.

Child quality of play assesses the child's sustained involvement with the toys and the quality of the child's play. Children engaging in high-quality play are consistently involved in their play, appear motivated throughout the task, clearly exert effort, make attempts at new forms of play, and play with confidence.

⁶⁰Woodcock, Muñoz-Sandoval, McGrew, and Mather (2007). The Woodcock Johnson IV Applied Problems subtest was not considered for this follow-up because the Spanish version is not yet available.

⁶¹The Woodcock Johnson III: Tests of Achievement produces *W* scores from raw scores to measure children's ability level, in addition to standard scores, which are normed to age- or grade-level peers.

⁶²Morin and Brooks-Gunn (2018).

⁶³U.S. Department of Health and Human Services, Administration for Children and Families, Office of Planning, Research, and Evaluation (1996-2010); Ware et al. (2000); Brady-Smith et al. (1999); Brady-Smith et al. (2000).

Parenting

Parent-Child Relationship

Parental warmth. The parental warmth subscale is conceptually derived from the Early Childhood Home Observation for Measurement of the Environment (EC-HOME), which is the most commonly used measure of the home environment in prior home visiting evaluations. The items in this subscale were rated by the field staff during the in-home/virtual assessment, for a total of eight items.⁶⁴ The items focus on the amount of affection and responsiveness between the caregiver and child, such as whether the caregiver praises the child. The study team will also examine the psychometric properties of these subscales by modality since these are observer-rated items. The virtual nature of the interaction may not afford the opportunity to observe certain interactions or behaviors. If this is the case, the kindergarten follow-up may use this variable to describe the sample, but not run impacts using it for sample members that were assessed virtually.

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 his or her parenting role. This outcome is measured using an adapted version of the Parenting Stress Index—Short Form.⁶⁵

Behavior Toward Child During Semi-Structured Task

Seven outcomes capture aspects of parent-child interactions during the Three-Bag Task, a semi-structured play interaction administered as part of the kindergarten in-home/virtual assessment. The parent and child were given three bags of interesting toys and asked to play with the toys in a sequence for 12 minutes. The interaction was video recorded and the parent's behavior toward the child was coded by child development researchers at the National Center for Children and Families at Teachers College, Columbia University using a strict coding protocol. This assessment was adapted for this evaluation from the Three-Bag Task coding scheme used at 14-, 24-, and 36-month follow-ups in the Early Head Start Research and Evaluation Project.⁶⁶

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 child's needs, moods, interests, and capabilities.

⁶⁴For the EC-Home, see Caldwell and Bradley (2003). Two additional items from the EC-HOME will be 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).

⁶⁵Whiteside-Mansell et al. (2007).

⁶⁶U.S. Department of Health and Human Services, Administration for Children and Families, Office of Planning, Research, and Evaluation (1996-2010); Ware et al. (2000); Brady-Smith et al. (1999); Brady-Smith et al. (2000).

Parental positive regard taps the mother's expression of love, respect, and/or admiration for the child. Positive regard is evidence in the way(s) in which the mother listens, watches attentively, and looks into the child's face when talking to child.

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.

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 the Three-Bag Task.

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 the Three-Bag Task.

Parental negative regard reflects the mother's expression of discontent with, anger toward, disapproval of, and/or rejection of the child during the Three-Bag Task

Aggression Toward Child

Psychological aggression assesses the frequency of behaviors such as yelling, screaming, or swearing at a child, or calling the child names in the past year. This outcome is measured using five items from psychological aggression subscale of the Conflict Tactics Scales: Parent-Child Version (CTSPC).⁶⁷

Physical aggression indicates whether the mother engaged in any acts of severe or very severe physical aggression in the past year. This outcome is measured using three items from the severe physical assault subscale of the CTSPC.

Child Maltreatment

Report of abuse 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 (reports of abuse and neglect at the 15-month follow-up point were measured through the time the focal child turned 15 months old) and the time of the kindergarten follow-up point. This outcome is measured using state administrative child welfare data.

Child hospitalizations for injuries or ingestions indicates the number of days the focal child has been hospitalized for an injury or ingestion from the 15-month follow-up point through the kindergarten follow-up point. This outcome is measured using Medicaid claims data.

Report of neglect 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 (reports of abuse and neglect at the 15-month follow-up point were measured through the time the

⁶⁷For the CTSPC, see Straus, Hamby, and Warren (2003).

focal child turned 15 months old) and the time of the kindergarten follow-up point. This outcome is measured using state administrative child welfare data.

Parental Support for Learning and Development

Frequency of reading indicates whether the child is read to daily. This variable construction aligns with this outcome at the MIHOPE 15-month follow-up.

Average amount of reading to child per day in the typical week indicates the average number of minutes the mother or a family member read to the child per day in the past week.

Cumulative amount of reading to child per day in a typical week indicates the total number of minutes the mother or a family member read to the child in the past week.

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.

Literacy activities in the home is a composite measure that is defined as the average of four binary indicators drawn from the parent survey: child read to parents (or others) outside of school; child looked at picture books outside of school; parents read books to child; and parents told stories to child. Each of these indicators will be dichotomized to indicate whether parents did the literacy activity at least three times per week.⁶⁸

Learning activities in the home is a composite measure that is the average of nine binary indicators drawn from the caregiver survey. Caregivers reported the frequency with which they sang songs with the child, helped child do arts/crafts, involved child in household chores, played games/did puzzles with child, talked about nature/did science projects, built something with child, played a sport or exercised together, engaged in writing activities, and did math activities such as learning numbers, adding, subtracting, or measuring. Each of these indicators will be dichotomized to indicate whether parents did the activity at least three times per week.⁶⁹

Percent of days absent from school assesses the percent of days the focal child was absent during the school year. This outcome is measured using school records data and items from the teacher survey.

Maternal Well-Being

Maternal Coping Strategies

Mastery measures the extent to which a person thinks life chances are under his or her control. This outcome is measured using the seven-item Pearlin Mastery Scale.⁷⁰

⁶⁸Bassok et al. (2016)

⁶⁹Bassok et al. (2016).

⁷⁰Pearlin and Schooler (1978).

Perceived social support measures how often various types of social support are available if needed. 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”). This item is measured using a five-item scale.⁷¹

Resource mobilization assesses whether mothers are able to find resources and feel empowered to do so. This outcome is measured using four items from the mobilizing resources subscale of the Healthy Families Parenting Inventory, which was developed specifically for home visiting programs.⁷²

Parental Distress

Parental distress assesses the overall level of parenting stress experienced by the mother. This outcome is measured using an adapted version of the Parenting Stress Index—Short Form.⁷³

Maternal Depressive Symptoms

Exhibits depressive symptoms indicates whether the mother was experiencing depressive symptoms at the time of the kindergarten follow-up survey. This outcome is measured using the standard 10-item version of the Center for the Epidemiologic Studies—Depression (CES-D) Scale.⁷⁴

Maternal Substance Use

Used illicit drugs indicates whether the mother used 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, or PRAMS.⁷⁵ These items appeared on the MIHOPE baseline and 15-month surveys. If the mother indicates that she used any of the drugs listed, then she is considered to have used substances in the past three months.

Excessive drinking indicates whether the mother engaged in heavy drinking or binge drinking in the past three months. This outcome is measured using two survey items about alcohol use that were adapted from the Pregnancy Risk Assessment Monitoring System, or PRAMS. If the mother indicates that she drank seven 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.

⁷¹McCarrier et al. (2011).

⁷²LeCroy and Milligan Associates, Inc. (2004).

⁷³Whiteside-Mansell et al. (2007).

⁷⁴Radloff (1977).

⁷⁵Pregnancy Risk Assessment Monitoring System (PRAMS) Data Portal (2018).

Family Conflict and Violence

Family Conflict

Family conflict assesses the amount of openly expressed anger or lack of cohesion among family members. This outcome is measured using five items from the family conflict subscale of the Family Environment Scale.⁷⁶

Intimate Partner Violence

Maternal experience with physical violence indicates whether the mother experienced physical violence in her current relationship. This outcome is measured using items from the physical assault subscale of the Revised Conflict Tactics Scale (CTS2).⁷⁷ These items align with the physical acts that have been included on ACE questionnaires (slap, hit, kick, push, or grab) and allow for continuity with earlier waves of MIHOPE data collection (baseline and 15-month follow-up).

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).⁷⁸ These items align with the physical acts that have been included on ACE questionnaires (slap, hit, kick, push, or grab) and allow for continuity with earlier waves of MIHOPE data collection (baseline and 15-month follow-up).

Women's 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 and were also used in earlier MIHOPE follow-ups.⁷⁹

Family Economic Self-Sufficiency

Material Hardship

Food insecurity indicates whether the mother experienced food insecurity. This outcome is measured using the six-item short-form U.S. Household Food Security Survey Module, which was included on the kindergarten follow-up survey.⁸⁰ Scoring for this measure is based on affirmative responses to these six items. Families with more than one affirmative response are considered to have food insecurity.

Material hardship 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

⁷⁶Moos and Moos (2009).

⁷⁷For the CTS2, see Straus, Hamby, and Warren (2003).

⁷⁸For the CTS2, see Straus, Hamby, and Warren (2003).

⁷⁹For more information on the Women's Experience with Battering scale, see Smith, Earp, and DeVellis (1995).

⁸⁰U.S. Department of Agriculture, Economic Research Service (2017).

and forgoing medical care due to cost). This outcome is measured using five items from the Poverty Tracker study, which were adapted from the Fragile Families and Child Wellbeing Study and the Survey of Income and Program Participation.⁸¹

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 kindergarten follow-up survey that asks about the number of times the respondent has moved in the past 12 months.

Employment and Income

Quarters employed in the past year assesses the number of quarters mothers have been employed in the past year. This outcome is measured using quarterly wage records from the National Directory of New Hires. The National Directory of New Hires (NDNH) will be used at the kindergarten follow-up to obtain information about maternal employment and earnings. Since these data are reported in calendar quarters (January through March, April through June, and so on), the outcome counts the number of quarters the mother had a quarterly wage record.

Earnings in the past year assesses mothers' average quarterly earnings in the past year. This outcome is measured using quarterly wage records from the National Directory of New Hires. Since these data are reported in calendar quarters (January through March, April through June, and so on), the outcome averages earnings across quarters.

Income 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 if they were unsure about their exact incomes.

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. Examples of "meaningful increases" include: the mother indicates 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 indicates on a follow-up survey that her highest level of education is grade 12 with a diploma or high school equivalent, some college or a college degree, or trade or technical school certificate; the mother indicates on the baseline survey that she has a high school diploma or equivalent, and she indicates on the follow-up survey that she has a college degree or a trade or technical school certificate; and the mother indicates on the baseline survey that she has a college degree and indicates on the follow-up survey that she earned a more advanced degree.

Among those without high school diploma at baseline, percentage with high school diploma assesses whether mothers who did not have a high school diploma at study entry indicate on the follow-up survey that they have at least a high school diploma or equivalent.

⁸¹See Robin Hood and Columbia Population Research Center (n.d.).

Public Assistance Receipt

TANF receipt indicates whether the mother reported on the kindergarten follow-up survey that she had received benefits in the past month from the Temporary Assistance for Needy Families.

SNAP receipt indicates whether the mother reported on the kindergarten follow-up survey that she had received benefits in the past month from the Supplemental Nutrition Assistance Program.

WIC receipt indicates whether the mother reported on the kindergarten follow-up survey that she had received benefits in the past month Special Supplemental Nutrition Program for Women, Infants, and Children.

Disability benefit receipt indicates whether the mother reported on the kindergarten follow-up survey that she had received benefits in the past month from Supplemental Security Income or Social Security Disability Insurance.

Medicaid receipt is based on whether Medicaid records indicate that the mother received benefits in the past month from Medicaid.

Appendix B

Constructs Excluded from Impact Analysis

Most constructs measured at kindergarten will be included in the impact analysis. However, there are three exceptions (see Table B.1).

Appendix Table B.1

Constructs That Will Not Be Included in Impact Analysis

Construct	Reason for exclusion
Child hospitalizations	Benefit-cost measure
Low birthweight birth or preterm birth since last follow-up	Benefit-cost measure
Number of child emergency department visits	Benefit-cost measure
Parent-child separations (foster care, mother's incarceration)	Benefit-cost measure
Receipt of early intervention services	Benefit-cost measure
Receipt of special education services	Benefit-cost measure
Involvement of the biological father or father figure with the child	Contextual measure
Child care setting before kindergarten	Contextual measure
Child has health insurance coverage	Contextual measure
Household order	Contextual measure
Maternal working memory	Contextual measure
Mother's relationship status	Contextual measure
Mother's relationship status with biological father of child	Contextual measure
Neighborhood characteristics	Contextual measure
School characteristics	Contextual measure
Number of births	Measurement & interpretation

First, estimated effects of home visiting will not be examined for constructs that were primarily included in the kindergarten follow-up because they provide contextual information. This is consistent with the approach shared in the MIHOPE kindergarten design report.

Second, and also consistent with the approach shared in the MIHOPE kindergarten design report, estimated effects will not be examined for constructs that were measured primarily because of their potential to inform a benefit-cost analysis. Instead, effects for these constructs will be examined at the point at which a benefit-cost analysis is conducted, at the time of the MIHOPE third grade follow-up.

Third, estimated effects will not be examined for the *number of births* measure. While birth spacing was identified as a construct of interest during the kindergarten design phase and *number of births* could serve as a proxy for understanding birth spacing, measurement and interpretation of this outcome are problematic. Simply knowing the number of births a mother had over the relatively long period of time between data collections is not a reliable measure of the intervals between those births (i.e., birth spacing). Studies have sometimes used number of births as a proxy for maternal health and economic and employment outcomes, but MIHOPE has direct measures of both of those constructs, so does not need to use birth spacing as a proxy. Intention about birth spacing is affected by personal factors such as age, religiosity, cultural influences, and preference, and there is not systematic causal evidence for the relationship between shorter birth

intervals and negative effects for families in the United States or about the length of intervals that are associated with negative effects.⁸² In addition, in making the decision to exclude the number of births outcome, the study team also considered earlier MIHOPE analyses. Effects on the birth interval between the MIHOPE child and a subsequent child were examined in the 15-month follow-up analysis and no statistically significant effects were found.

⁸²See for example, Ahrens et al. (2018) and American College of Obstetricians and Gynecologists, & Society for Maternal-Fetal Medicine (2019).

Appendix C

Sampling and Administrative Data Availability from State and Local Sources

Sampling: Planned Missingness

As described in the MIHOPE long-term design report, the study team reduced the burden of data collection on families by randomly choosing which families were asked to provide which type of information.⁸³ The basic idea behind this strategy—which is sometimes referred to as “planned missingness”—is that collecting some information from a subset of the sample allows the study to collect a wider set of information than it could otherwise, while state-of-the-art methods for working with missing data minimize the extent to which the precision of the impact estimates is affected.⁸⁴

One example of planned missingness is the multiform design, in which multiple forms of a survey are each conducted with a randomly chosen subset of families.⁸⁵ In the MIHOPE kindergarten caregiver survey, the multiform design was applied in two ways: by asking each family a subset of questions from a scale (item missingness) and by asking each family certain scales or constructs (construct missingness).⁸⁶

Item missingness. Asking a subset of questions on a scale provides an unbiased estimate of the underlying construct but leaves more room on the survey to measure other constructs. Item missingness was used on the kindergarten caregiver survey with the following scales: the engagement, self-control, externalizing behaviors, hyperactivity/inattention, and internalizing behaviors subscales from the Social Skills Improvement System (SSIS) and the parental distress and parent-child dysfunctional interaction subscales from the Parenting Stress Index—Short Form. The survey was designed so that certain items within a scale are missing for one-third of respondents.

Construct missingness. The following constructs were included in the team’s construct missingness plan: mobilizing resources; mastery; household order; cognitive stimulation; family conflict; social support; public assistance amounts; public assistance months of receipt; child SSI; employment; income; housing; food insecurity; and material hardship. The survey was set up so that these constructs are missing for one third of respondents.

Administrative Data Availability from State and Local Sources

The study team attempted to obtain school records and child welfare administrative data from all twelve MIHOPE states but, as of August 2023, has not been able to execute agreements with all these state agencies because of agencies’ inability or unwillingness to provide data. For school records, the study team has signed data use agreements with states or localities that include 56 percent of the sample. For child welfare records, the study team has signed data use agreements with states that include 74 percent of the MIHOPE sample.

⁸³Faucetta et al. (2020).

⁸⁴See Lang and Little (2016).

⁸⁵Graham, Taylor, Olchowski, and Cumsille (2006).

⁸⁶As an example of item missingness, consider a scale with nine items, one-third of sample members could be asked to answer items one, two, four, and seven; one-third could be asked to answer items one, two, five, and eight; and one-third could be asked to answer items one, two, three, six, and nine. An example of construct missingness is to ask only one-third of sample members all the items in a particular scale.

The study team will assess the representativeness of this data and include the results of these analyses in the kindergarten report.

Appendix D

Rationale for Strategy to Focus Impact Analysis

The MIHOPE kindergarten impact analysis includes dozens of outcomes. To determine how to systematically interpret these results, the study team considered broad conceptual questions such as:

- What should the focus of the kindergarten analysis be?
- What research questions should be emphasized?
- What information will be useful to the home visiting field?

These conceptual questions underlie a series of decisions; the remainder of this appendix describes the rationale for these decisions.

1. Using formal tests to aid in the interpretation of effects

Using formal tests to help interpret the findings is consistent with the approach used in earlier MIHOPE analyses. The alternative would be to interpret patterns of effects without using formal tests, but the study team did not think this is a viable option for the kindergarten analysis for the following reasons:

- In earlier MIHOPE follow-up analyses, the study has set a precedent of using formal tests (omnibus tests and Westfall-Young adjustments) to aid in the interpretation of patterns of effects and aid in drawing conclusions about the results.
- The absence of formal tests has the potential to contribute to uncertainty and disagreement about the findings.

2. Choosing formal tests

Given the value of moving forward with using formal tests to interpret the results, the study team considered the tests that would be best suited to the current structure of the kindergarten impact analysis. There are more than 60 outcomes on which to examine effects, and the study team was not able to reduce the number of tests they needed to conduct to a small number. The team considered various strategies for reduction, such as conducting a test on one composite p-value for each outcome area or elevating some outcomes as confirmatory. However, given the available data and limited information available in the prior literature about the effects of home visiting at similar follow-up points, the study team thought that these strategies would not be as effective as interpreting overall patterns of effects across groups of outcomes.

Because the goal is to make statements about the overall pattern of effects for groups of outcomes, omnibus tests will be used as a lens through which to interpret findings.

Omnibus tests can provide information about whether there are positive effects somewhere in a group of outcomes without indicating where the effects are positive. This approach can be powerful in studying home visiting since impacts might be small but spread across many outcomes. In contrast, a Westfall-Young adjustment, a different formal test used in earlier MIHOPE analyses, can only help interpret effects for *individual* tests (individual outcomes), by adjusting individual tests for the other tests being conducted. Using a Westfall-Young adjustment for 66

outcomes would result in 66 adjusted p-values, which would not aid in focusing the analysis or framing the results.

Omnibus tests were used in the MIHOPE 15-month analysis, and again in the 2.5 and 3.5-year analyses, to aid in the interpretation of effects across groups of outcomes.

3. Using omnibus tests

Because omnibus tests will be used to aid in the interpretation of patterns across groups of outcomes, the team also considered how to construct these groups. One option was to conduct omnibus tests across the outcomes within each outcome area, but the outcome areas are broad and may not be conceptually coherent enough to provide relevant information.

Rather than using the same type of organizational units as in past MIHOPE analyses to group outcomes, the decision was made to group outcomes to help interpret the answers to explicitly stated research questions. In answering these research questions, the analyses can draw on outcomes from multiple outcome areas or from within an outcome area.

4. Research questions the report can answer

The next decision to make concerned which explicitly stated research questions will guide the interpretation of findings in the kindergarten report. As described above, practitioner- and policy-relevant research questions were identified that can be used to group outcomes, so that the team can then conduct omnibus tests to describe effects for those groups of outcomes. The *Focusing the impact analysis* section shows the list of prespecified topical research questions that aim to provide relevant information for practitioners and policymakers.

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