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Parents as Teachers Family Outcomes: New Insights from the Mother and Infant Home Visiting Program Evaluation

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Introduction

Evidence shows home visiting has potential to address a range of outcomes for young children and their families. Improvements in parenting practices, child development, maternal and child health, child maltreatment, and family economic self-sufficiency among others have been attributed to home visiting (Filene et al., 2013; Health Resources and Services Administration [HRSA], 2020; Kendrick et al., 2000; Lugo-Gil & Tamis-LeMonda, 2008; Sama-Miller et al., 2017). Home visiting, though, is not a uniform intervention. There are a variety of early childhood home visiting models, each with different participant eligibility criteria, curricula, dosage expectations, and home visitor education requirements among other factors. The U.S. Department of Health and Human Services Home Visiting Evidence of Effectiveness (HomVEE) has established evidence for 23 models (HomVEE, 2023). Of those, Parents as Teachers (PAT) has the broadest reach with over 73,000 participating families across 48 states and the District of Columbia in 2022 (National Home Visiting Resource Center [NHVRC], 2023).

As funders and communities decide how to allocate limited resources to promote family well-being, it is imperative to have comprehensive information on established outcomes at the model level, especially for subgroups of families. Models that can improve a wider range of outcomes for either a greater variety of families or, more importantly, for different types of families in the community of interest could eventually produce better outcomes for families served and greater societal returns on the investments.

Parents as Teachers

PAT is an evidence-based early childhood home visiting model that connects a parent educator with caregivers with children prenatal to Kindergarten to promote the family's well-being. The parent educator provides regular visits (typically in the family's home) to assess family needs and partner with caregivers to set family goals. Parent educators provide child development and parenting information and resources, developmental and health screenings, parent-child activities and assessments, linkages to local services, and invitations to PAT-sponsored group events for families. They also discuss the family's background and "stressors" (e.g., young parents, fewer economic resources) which informs the frequency of home visits. Those with two or more stressors receive an average of two home visits per month while those with fewer stressors receive one monthly visit. PAT provides home visits for at least two years. Families can enroll in PAT at any point from pregnancy until the child enters Kindergarten, though local programs may set parameters within that range (e.g., prioritizing infants) (NHVRC, 2023).

Evidence has been previously established for several outcomes among PAT participants. The five research studies that met HomVEE rigorous criteria for moderate or high evidence found that PAT

improved certain aspects of child development and school readiness related to gross motor, language, and mental processing skills (Drazen & Haust, 1993), task competence (Drotar et al., 2009), and self-help, though this same study also found a negative or ambiguous impact on social development (Wagner et al., 1999). Studies listed on HomVee showed that PAT had a short-term influence on positive parenting practices with one finding that young parents in PAT showed greater parental responsiveness and overall quality and quantity of parental stimulation and sensitivity in the home environment after one year (Wagner et al., 1996), though another found negative impact on acceptance of child behavior and approach to discipline after two years (Wagner et al., 1999). Lastly, one of these studies found PAT positively influenced family economic self-sufficiency with lower reliance on welfare (Drazen & Haust, 1993).

Other studies not meeting HomVEE's standards for review or evidence have found PAT positively influenced a broader set of outcomes related to child development and school readiness (O'Brien et al., 2002), parenting practices (Albritton et al., 2004; Neuhauser et al., 2018; Pfannenstiel, 2015), child maltreatment prevention (Chaiyachati et al., 2018), and child health (Neuhauser et al., 2018; Wagner et al., 2001). Yet without HomVEE's assessment of rigor, these studies may not provide sufficient evidence on their own to firmly establish PAT's impact on each of these outcome domains for young children and families.

Other rigorous research has studied PAT outcomes for families in a variety of ways such as in other countries, impact for school-age children, or for a subset of families. For instance, a Randomized Controlled Trial (RCT) in Switzerland found significant positive impacts on child development such as language skills and adaptive behavior by age three (Schaub et al., 2019). A quasi-experimental study of school-age children found those who had participated in PAT before kindergarten showed greater academic skills than the matched comparison group (Lahti et al., 2019). And another RCT focusing on a subgroup of families with at least one child protective services (CPS) report found that families for whom this was their first report had fewer additional CPS reports after participating in PAT (Jonson-Reid, et al., 2018). While informative, these other studies do not assess outcomes for typical PAT participants (i.e., young children and their parents) in the U.S.

The U.S.-based rigorous studies focusing on young children and meeting HomVEE's evidence-based criteria were published over ten years ago when PAT affiliates had less explicit model implementation guidance (now more explicit) and were using Born to Learn Curricula. PAT's updated Foundational Curricula was introduced in 2010 and included additional content that aligned with the PAT model goals and outcomes, including (PAT, 2023):

- Increase parent knowledge of early childhood development and improve positive parenting practices.
- Provide early detection of developmental delays and connection to services.

- Improve parent, child and family health and well-being.
- Prevent child abuse and neglect.
- Increase children’s school readiness and success.
- Improve family economic well-being.
- Strengthen community capacity and connectedness.

Findings and Limitations of the Mother and Infant Home Visiting Program Evaluation

PAT was one of four home visiting models studied in the Mother and Infant Home Visiting Program Evaluation (MIHOPE) , a RCT assessing home visiting implementation and its impact for participating families. Families were randomly assigned to an evidence-based home visiting program or to a control group who was given information on other services available in the community. The randomization helped to ensure the two groups were similar in all respects except their access to home visiting services.

MIHOPE collected data on families for the implementation study from 2012-2016 (Duggan et al., 2018) and for the outcome study from 2012-2017 (Michalopoulos et al., 2019). The MIHOPE outcome study collected family-level data at study entry (baseline) and when the child turned 15 months old (follow up). MIHOPE conducted extensive analysis on family data aggregated across the four models with more limited analysis at the model level. MIHOPE reported on 57 model-level outcomes in seven domains: child development, child health, child maltreatment, family economic self-sufficiency, intimate partner violence (IPV), maternal health, and parenting. PAT showed significant, positive impact on at least one outcome in two domains: parenting and child development. In the parenting domain, PAT had a significantly positive impact on quality of the home environment, parent supportiveness, awareness of health and safety hazards, parental use of control during a parent-directed clean up task, and dysfunctional interaction between parent and child. In the child development domain, PAT children were significantly more likely to engage the parent during a play activity. Conversely, PAT had a significant negative impact in the child health domain. PAT children were less likely to be normal weight and more likely to be at risk for overweight based on measurements of weight for length (Knox & Michalopoulos, n.d.).

While MIHOPE explored home visiting outcomes for a variety of subgroups of families in the aggregate analysis across models, no subgroup findings were reported at the model level. For instance, MIHOPE analysis did not consider the impact of PAT on subgroups including race/ethnicity and other family circumstances (e.g., family composition, maternal characteristics). MIHOPE did, however, collect data on curricula used across study site locations. PAT’s Foundational Curricula was used in over half of the study sites, regardless of model, meaning some Nurse-Family

Partnership, Early Head Start, and Healthy Families America sites also used the PAT Foundational Curricula (Duggan et al., 2018).

These findings are conservative as MIHOPE used an intent to treat (ITT) approach, analyzing families in their assigned treatment and control groups regardless of how many visits a family received. MIHOPE reported that 21% of families in the study assigned to PAT did not receive any visits (the treatment) (Michalopoulos et al., 2019). With over a fifth of the treatment group representing families assigned to PAT who did not receive any home visiting, it is possible PAT could have additional outcomes for families who received at least some of the intervention. Moreover, there are opportunities to further explore the impact of PAT curricula on family outcomes across the four models in the MIHOPE study.

Study Objectives

MIHOPE data are now available under restricted use for additional analyses through the Inter-university Consortium for Political and Social Research (ICPSR), part of the Institute for Social Research at the University of Michigan (Knox & Michalopoulos, 2022). The objective of this project is to use rigorous methods to further explore outcomes in MIHOPE data for PAT study participants that received at least some PAT services. This study uses a quasi-experimental design to answer four research questions: 1) What impact does PAT have on family outcomes among those who received at least three months of home visits? 2) Of the outcomes PAT impacts, what effect does PAT have on these family outcomes for different racial/ethnic groups? 3) Of the outcomes PAT impacts, what effect does PAT have on these family outcomes for other subgroups of families? and 4) What is the impact of the PAT Foundational Curricula on family outcomes among those who received at least three months of home visits?

Methods

Study Design

To examine the impact of PAT on family outcomes, this study focused on families who were assigned to PAT and received at least three months of home visits. With this sample, families are not randomly assigned to the treatment and control groups and the study is no longer a rigorous RCT. We used a quasi-experimental method with propensity score matching (PSM) to minimize the effects of confounding and construct a sound comparison group. Confounding can occur if some covariates are related to both the treatment assignment and the outcome. This could lead to selection bias and systematic differences between treatment and comparison groups. Consequently,

an unbiased estimated effect cannot be obtained by directly comparing outcomes between two groups (Austin, 2011).

WCG IRB deemed the study exempt from review because it utilized secondary data from the MIHOPE study. Informed consent was obtained as part of MIHOPE which covered secondary data analysis for subsequent research.

Propensity Score Matching

PSM is a statistical technique that matches each treated subject with one or more comparison subjects of similar characteristics based on the propensity score (Rosenbaum & Rubin, 1985). The propensity score is defined as the probability of assignment to treatment conditional on a set of observed baseline covariates (Rosenbaum & Rubin, 1983). In the subsequent outcome analysis, the treatment effect can be estimated by comparing outcomes between treated and comparison subjects in the matched sample. We used several methods to ensure the propensity score produced valid matches for estimating the impact of PAT. First, we reviewed both the pre-random assignment characteristics MIHOPE found to be correlated with the outcomes of interest and the home visiting outcomes literatures to identify confounders, to select a well-conceived set of matching variables that include relevant baseline characteristics related to treatment participation and outcomes (Rubin & Thomas, 1996). The final set of matching variables was comprehensive and is described further in the next section (see covariates). Second, we restricted the analysis to only those subjects that had propensity scores in the common support region for matching (Stuart, 2010). This ensures that the subjects with the same covariate values have a positive probability of being both treated and untreated. Third, we assessed the equivalence or balance of variables by comparing the distributions between the treated and comparison groups after matching, including standardized bias testing (Rubin, 2001; Stuart, 2010), variance ratio testing, significance testing (Gemici et al., 2012; Oakes & Johnson, 2006), and a variety of graphical methods for visual comparison. Lastly, to improve the balance, we adjusted the matching model by selecting different matching algorithms and using a different set of matching criteria (Austin, 2014). These adjustments met the standard criteria for balance, indicating no meaningful differences on any matching variables between the treatment and comparison groups at baseline.

Estimated Effects on Family Outcomes

Once variable balance was achieved, we replicated the impact analysis that MIHOPE conducted and examined a total of 67 key family outcomes across MIHOPE's seven domains including child development, child health, child maltreatment, family economic self-sufficiency, IPV, maternal health, and parenting. These include both the 12 outcomes that MIHOPE identified as "confirmatory" outcomes— where previous studies had consistently found effects or that have objective measures

that come from observations or direct child assessments, and the others considered as “exploratory” outcomes— where past empirical evidence did not clearly suggest that these outcomes were affected but families may still be benefited from the increased effects over time (Michalopoulos et al., 2019). The effects of PAT among those who received at least three months of home visits were estimated by comparing the outcomes of the matched treatment and comparison groups, controlling for family background characteristics. We fit the generalized linear model to estimate the effects and the generalized least squares (GLS) estimation was used to calculate the impact of PAT. Pre-random assignment characteristics of families and the enrolled site were used as covariates (selected as described above in PSM matching variables) to reduce any slight remaining imbalance (Greifer & Stuart, 2022) and increase the statistical precision of the estimated impacts because theory or prior research evidence suggested they were correlated with the outcomes of interest (Nguyen et al. 2017; Rubin, 1973; Rubin & Thomas, 2000; Wan, 2019). See Exhibit 1 for matching variables and covariates. For each covariate, following the single imputation method that MIHOPE implemented, missing data were addressed with the missing indicator method (Choi et al., 2006). We also conducted two sensitivity analyses to check whether the effects are sensitive to the decisions that were made in choosing a different set of covariates or using a different matched dataset that was generated by another matching method. Lastly, we used a p value of less than .1 to indicate significance to mirror MIHOPE’s analytical criteria.

Exhibit 1. Baseline Matching Variables and Covariates

Maternal Characteristics
<p>Demographics</p> <ul style="list-style-type: none"> • Age • Race • Ethnicity • Place of birth • Marital status • Number of children in the household • English proficiency
<p>Family Economic Self-sufficiency</p> <ul style="list-style-type: none"> • Level of education • Whether the mother was receiving education or training • Employment status • Food security • Receipt of benefits from the Supplemental Nutrition Assistance Program, Supplemental Security Income, Temporary Assistance for Needy Families, or the Special Supplemental Nutrition Program for Women, Infants, and Children

Maternal Characteristics

Maternal Physical Health

- Health status
- Childbearing intentions
- Health insurance coverage
- Smoking before pregnancy
- Intention to breastfeed (if pregnant)
- Pregnancy status at study entry
- Body mass index

Maternal Substance Use and Mental/Emotional Health

- Substance use before pregnancy
- Previous receipt of behavioral health services
- Depression or anxiety
- Verbal abstract reasoning
- Verbal skills

Maternal Experience with Violence and the Justice System

- Experience of physical or sexual violence
- Perpetration of physical violence
- Receipt of domestic violence services
- Experience with battering
- Previous arrest

Family Relationships and Parenting

- Quality of relationship with partner
- Parental empathy
- Parental warmth, lack of hostility, mastery
- Home interior
- Whether any child had involvement with child welfare services

Child Characteristics

For children who were born before the family entered the study:

- Age at enrollment
- Sex
- Child temperament
- Whether the child had a usual source of care
- Whether the child had poor health at birth

Subgroup Analysis

To evaluate how the impact of PAT on family outcomes varied by subgroups, we performed subgroup analysis among nine categories of family characteristics that were developed and derived based on the subgroups that MIHOPE has defined and reviewed (Breck & Wakar, 2021). To identify the subgroups to study, we looked at prior research that suggested family characteristics that might be related to outcomes. We also looked at the distribution across PAT and comparison families on a variety of family characteristics to identify those variables that seemed to have variation within the treatment group to support comparison. Finally, we looked at MIHOPE characteristics and leaned heavily toward the family characteristics prioritized in MIHOPE.

The subgroup analysis was based on family characteristics at study entry, including: 1) race/ethnicity (African American/Black, Hispanic/Latina, White, or Multiracial/Another race); 2) pregnancy status at study entry (pregnant, not pregnant); 3) first-time mother (first birth, prior births); 4) maternal education (less than high school, high school or more); 5) IPV (experienced or perpetrated IPV in year prior to study, or not); 6) maternal emotional functioning (low, moderate, and high based on composite measure of the presence of depression, relationship anxiety, and/or relationship avoidance at study entry); 7) maternal psychological resources (at or below the median score, or above the median score based on composite measure of mothers' mental health including depressive symptoms and anxiety, mastery, and verbal abstract reasoning); 8) father/other adult relative in the home (biological father or other adult relative lives in home, or not); and 9) demographic risk (low, moderate, or high risk based on composite measure of whether mother received public assistance or Medicaid, the mother was 20 years old or younger, the child's biological father did not live in the home, and 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). This analysis examined differences in effects on the 12 outcomes which PAT was found to have a statistically significant impact in the overall analysis, with p-values adjusted for the multiple comparisons using the Holm-Sidak adjustment method (Blakesley et al., 2009). We conducted a separate stratified analysis on each subgroup within every family characteristic for each outcome. In other words, among Hispanic or Latina families, for example, we compared those who received PAT to those who did not receive PAT for each of the 12 outcomes.

Results

Family Characteristics

Families in the study do not fit one mold, but rather show variation across many characteristics. The PAT group (n=218) and comparison group (n=225) exhibited very similar baseline characteristics

after matching for research questions 1-3. About one third of mothers in the study were Hispanic/Latina (PAT: 36.3%, Comparison: 36.8%), one third were White (36.2%, 37.4%), and about one fifth were African American/Black (20.2%, 20.9%). The largest group of mothers had less than a high school degree or equivalent at baseline (40.8%, 44.0%), though about a quarter had some college or higher (26.6%, 22.5%). Most mothers were steadily employed for more than 12 months during the prior three years (50.0%, 46.8%), and about one fifth had no work experience in that timeframe (19.7%, 22.0%). Most had a live-in partner at baseline, either married to the child's biological father (37.2%, 32.3%) or cohabitating with a partner (22.5%, 23.2%).

Mothers experienced a range of health indicators at baseline. Just under half were pregnant (44.0%, 44.0%). About a third reported symptoms of depression or anxiety (33.5%, 30.7%) while a smaller portion received behavioral health services for alcohol, substance use, or mental health in the year prior to study entry (20.2%, 18.3%). Most had health insurance or health coverage (89.4%, 89.0%).

Children in the study were two months old on average at baseline (PAT: 1.9 months, Comparison: 2.0 months). Approximately a quarter of the infants were under 5.5 pounds at birth, born three weeks or more premature, or spent time in the neonatal unit (NICU) (27.9%, 24.6%). Participation in child welfare was rare before study entry (4.1%, 4.1%).

Family Outcomes

When we narrow the PAT treatment group to those who had at least three months of home visits, participants had statistically significant positive outcomes in five of seven outcome domains at the 15-month follow up. Those included child development, child health, child maltreatment, family economic self-sufficiency, and parenting. In one other domain, IPV, the outcomes are trending in the right direction but were not significant. Exhibit 2 shows the 12 statistically significant family outcomes out of 67 tested across the domains in this study.

The parenting domain had the largest number of significant outcomes. In this study, PAT mothers showed greater awareness of health and safety hazards at the 15 month follow up than families not in PAT (mean score 3.7 v. 3.4, $p < .05$). This is a score ranging from 1 to 5 based on their awareness of the need to have the child always ride in a car seat, awareness of how the family can be exposed to lead in the environment, awareness of steps to take to prevent family exposure to lead, awareness of how eating fish containing high levels of mercury can affect the baby, and awareness of shaken-baby syndrome. PAT mothers also showed greater overall parental supportiveness than the comparison group (mean score 4.1 v. 4.0, $p < .1$). This was measured during a semi-structured play interaction at the 15-month follow up. The interaction was video recorded, and the parent's behaviors were coded by child development researchers. This parent supportiveness measure consisted of three subscales. PAT families did significantly better on the parental sensitivity subscale (i.e., extent to which the caregiver takes the child's perspective and understands and responds to

the child’s signals), and the parental stimulation of cognitive development subscale (i.e., caregivers take steps to stimulate the child’s cognitive development). PAT families were also less likely to use a controlling form of discipline rather than motivating the child during a clean-up activity (mean score 2.9 v. 3.2, $p < .05$).

Exhibit 2. PAT Family Outcomes at 15 Month Follow Up

Outcome ^a	New Analysis: Received 3+ Months of PAT		
	New PAT Group ^b N = 218	New Comparison Group ^c N = 225	Difference (Effect)
Child Development			
Behavior problems	43.1	44.0	-0.8
Receptive language skills	94.6	91.4	3.2 ^x
Social-emotional competence	27.4	27.5	-0.1
Received any early-intervention services (%)	5.4	4.1	1.3
<i>Child behavior during semi-structured play with the parent</i>			
Child’s engagement of the parent	4.3	4.1	0.1
Sustained attention to objects	5.5	5.3	0.1
Negativity toward the parent	1.8	2.0	-0.2
<i>Child behavior during a parent-directed task</i>			
Compliance	1.7	1.6	0.1
Distress	1.7	1.9	-0.2
Child Health			
Any Medicaid-paid health care encounter for injury or ingestion (%)	16.1	27.7	-11.6 ^{**}
Number of Medicaid-paid well-child visits	4.5	4.4	0.0
Health insurance coverage for the child (%)	94.5	92.1	2.3
Number of Medicaid-paid child emergency department visits	1.6	2.1	-0.5 ^x
Primary care provider for the child (%)	88.5	89.8	-1.3
Number of Medicaid-paid immunizations	4.0	3.9	0.2

Outcome ^a	New Analysis: Received 3+ Months of PAT		
	New PAT Group ^b N = 218	New Comparison Group ^c N = 225	Difference (Effect)
Any Medicaid-paid nonbirth hospitalizations (%)	17.0	18.7	-1.7
Weight for length (%)			
Underweight	10.4	10.6	-0.2
Normal weight	57.5	61.2	-3.8
At risk of overweight	32.3	28.2	4.0
Duration of breastfeeding (months)	4.2	5.4	-1.2
Child Maltreatment			
Frequency of minor physical assault during the past year	2.0	2.1	-0.1
Frequency of psychological aggression during the past year	2.9	3.2	-0.3
Severe or very severe physical abuse by mother (%)	1.0	1.4	-0.4
Any substantiated maltreatment report (%)	1.8	2.1	-0.2
Any maltreatment report (%)	5.6	12.4	-6.9***
Loss of custody (%)	2.6	2.5	0.2
Family Economic Self-Sufficiency			
Mother receiving education or training (%)	22.4	12.4	10.0*
Received any Supplemental Nutrition Assistance Program benefits during the past month (%)	54.0	62.8	-8.8 ^x
Received any Temporary Assistance for Needy Families benefits during the past month (%)	13.3	15.6	-2.3
Received any Women, Infants, and Children benefits during the past month (%)	69.1	66.0	3.0
Received any disability insurance during the past month (%)	6.7	9.8	-3.2
Food insecurity in 12 months prior to 15 month follow up (%)	35.9	36.0	-0.1
Use of nonparental child care (%)	42.2	31.7	10.5*

Outcome ^a	New Analysis: Received 3+ Months of PAT		
	New PAT Group ^b N = 218	New Comparison Group ^c N = 225	Difference (Effect)
Received any transportation services (%)	7.5	9.2	-1.7
Intimate Partner Violence			
Maternal experience physical or sexual violence (%)	3.3	6.3	-3.0
Maternal perpetration of physical violence (%)	8.8	11.3	-2.6
Maternal experience with battering (%)	4.0	8.1	-4.1
Mother received any domestic violence services (%)	2.0	2.2	-0.2
Mother received any services from a domestic violence shelter (%)	0.6	1.8	-1.2
Maternal Health			
New pregnancy after study entry (%)	13.4	12.8	0.6
Health insurance coverage for the mother (%)	78.2	76.0	2.2
Current smoking (%)	21.7	23.6	-1.9
Substance use during the past three months (%)	15.9	12.5	3.5
Current depressive symptoms (%)	23.1	27.0	-3.8
Health status self-rated as “poor” or “fair” (%)	18.1	22.8	-4.7
Received any behavioral health services (%)	12.3	10.7	1.6
Parenting			
Quality of the home environment (overall)	39.1	39.0	0.2
Parental supportiveness (overall)	4.1	4.0	0.2 ^x
Awareness of health and safety hazards	3.7	3.4	0.3 [*]
<i>Specific aspects of quality of the home environment</i>			
Parental warmth	6.5	6.5	0.0
Parental support for learning and literacy	14.1	14.3	-0.1
Parental verbal skills	2.9	3.0	0.0
Parental lack of hostility	4.8	4.8	-0.1

Outcome ^a	New Analysis: Received 3+ Months of PAT		
	New PAT Group ^b N = 218	New Comparison Group ^c N = 225	Difference (Effect)
Home interior	7.3	7.3	0.1
<i>Specific aspects of parental supportiveness:</i>			
Parental sensitivity	4.2	4.0	0.2*
Parental positive regard	4.17	4.14	0.03
Parental stimulation of cognitive development	3.9	3.8	0.2 ^x
<i>Parental unsupportiveness</i>			
Parental intrusiveness	2.7	2.8	-0.1
Parental negative regard	1.5	1.5	0.0
Parental detachment	1.6	1.8	-0.2
<i>Parental discipline</i>			
Nonviolent discipline (%)	57.3	64.3	-7.0
Gentle guidance	2.66	2.62	0.04
Control	2.9	3.2	-0.3*
<i>Parental stress</i>			
Parental distress	10.5	10.8	-0.3
Parent-child dysfunctional interaction	9.8	10.1	-0.4

Notes:

^x p<.1

* p<.05

** p<.01

*** p<.001

^a Sources: Outcomes were calculated based on the MIHOPE 15-month follow-up survey, the 15-month in-home assessment, Medicaid enrollment and claims data, National Database of New Hires, state administrative child welfare records, and the parent-child video-recorded interaction.

^b Maximum sample size = 218; sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source. Among 483 PAT families, 265 families received at least one home visit. Propensity score matching was then used to craft a control group that is comparable on all observed covariates to families that received PAT visits. Among 265 families that received home visits, 218 families were able to be matched with one or more control families of similar characteristics. Sample was constructed with variable HVLAN_TOTALVISITS_YRB415: Number of visits in the 12 months prior to the 15-month survey.

^c Maximum sample size = 225; sample sizes may vary depending on a specific measure's data source and the frequency of missing values within that data source. Among 476 control families, 225 families were able to be matched with PAT family of similar characteristics.

Distributions may not add to 100 percent because of rounding.

The family economic self-sufficiency domain had the next highest number of significant outcomes. PAT mothers were more likely to be receiving education or training at the 15-month follow up than the comparison group (22.4% v. 12.4%, $p < .05$). PAT families were more likely to be using nonparental child care on a regular basis, at least once a week at the 15 month follow up (42.2% v. 31.7%, $p < .05$). They were also less likely to be receiving any Supplemental Nutrition Assistance Program (SNAP) benefits during the past month at the 15 month follow up (54.0% v. 62.8%, $p < .1$), which could be interpreted multiple ways. Receiving less SNAP could mean they are working and no longer qualify, or it could mean they are not receiving the benefits they need.

Across the other domains, for child health, children in PAT had fewer Medicaid-paid health care encounters for injury or ingestion (16.1% v. 27.7%, $p < .01$) or emergency department visits (1.6 v. 2.1, $p < .1$) between study entry and the 15-month follow-up than similar children not in PAT. In the maltreatment domain, PAT families were less likely to have any maltreatment reports between study entry and when the child turned 15 months old (5.6% v. 12.4%, $p < .001$). In the child development domain, children in PAT showed better receptive language skills at the 15-month follow up compared to children not in PAT as measured using the auditory comprehension subtest of the Preschool Language Scales in English and Spanish with a standard score range of 50 to 150 (mean score 94.6 v. 91.4, $p < .1$). PAT families did not have statistically significant outcomes in the IPV and maternal health domains. Analyses for research questions 2 and 3 were limited to the 12 outcomes where PAT was found to have a statistically significant impact in the overall analysis.

Outcomes by Race/Ethnicity

To understand the impact of PAT on family outcomes by racial/ethnicity, we stratified on race/ethnicity, assessing differences between treatment and comparison groups in separate analyses for each racial/ethnic group. Separate analyses were conducted for Black or African American families, Hispanic or Latina families, White families, and families identifying in another racial group or in multiple groups. Of the 12 outcomes on which PAT was found to have a statistically significant impact in the overall analysis, six outcomes had significantly different levels of impact by race or ethnicity (Exhibit 3).

Exhibit 3. Overview of Significant Family Outcomes by Subgroup

Outcome	Race/ Ethnicity	Pregnancy Status at Study Entry	First- Time Mothers	Educational Attainment	Intimate Partner Violence (IPV)	Maternal Emotional Functioning	Psychological Resources	Other Adults in Home	Demographic Risk
Child Development									
Receptive language skills	Black*			Less than HS**				No Other Adults in Home*	Moderate Level* High Level*
Child Health									
Any Medicaid-paid health care encounter for injury or ingestion (%)		Pregnant*	First Child* Prior Births*	HS or more*			Above Median*	Other Adults in Home*	Low Level*
Number of Medicaid-paid child emergency department visits	Other/ Multiracial**		First Child*			High Level*	Above Median*	Other Adults in Home*	
Child Maltreatment									
Any maltreatment report (%)	White**	Not Pregnant**	Prior Births**	HS or more**		Moderate Level* High Level*	At or Below Median* Above Median*	Other Adults in Home* No Other Adults in Home**	Low Level* High Level*
Family Economic Self-Sufficiency									
Mother receiving education or training (%)			First Child*	Less than HS*	No IPV**	High Level*	Above Median**	Other Adults in Home*	

Outcome	Race/ Ethnicity	Pregnancy Status at Study Entry	First- Time Mothers	Educational Attainment	Intimate Partner Violence (IPV)	Maternal Emotional Functioning	Psychological Resources	Other Adults in Home	Demographic Risk
Received any Supplemental Nutrition Assistance Program benefits during the past month (%)	Black*			HS or more*			Above Median*		
Use of nonparental child care (%)		Not Pregnant *			IPV*				
Parenting									
Awareness of health and safety hazards	Black*	Pregnant *					Above Median*	No Other Adults in Home*	
Parental supportiveness (overall)						Moderate Level*	At or Below Median**		Moderate Level*
Parental Supportiveness: Parental Sensitivity				Less than HS*		Moderate Level*	At or Below Median**		Moderate Level*
Parental Supportiveness: Parental stimulation of cognitive development									
Parental Discipline: Control	Hispanic*	Not Pregnant *		Less than HS*	No IPV*				Low Level*

Notes:

- * $p \leq .1$
- * $p \leq .05$
- ** $p \leq .01$
- *** $p \leq .001$

Black or African American families in PAT showed the greatest number of significant differences compared to other racial or ethnic groups. Black families in PAT (n= 44) had a significant improvement in three outcomes compared to similar Black families not in PAT (n= 46). Black PAT participants showed significantly greater awareness of health and safety hazards than their comparison group (mean score 4.3 v. 3.5, $p < .1$), and also a greater decrease in the receipt of SNAP benefits at follow up compared to Black families not in PAT (42.9% v. 48.7%, $p < .1$). In addition, young Black children in PAT displayed significantly better receptive language skills than similar children not in PAT (mean score 95.8 v. 87.3, $p < .1$).

For Hispanic or Latina families, those in PAT (n=51) had a significant improvement in parental discipline: control compared to Hispanic families not in PAT (n=61), meaning they were less likely to direct and control their children's actions during a clean activity and more likely to encourage and motivate their children (mean score 2.6 v. 3.2, $p < .05$). Among White families, those in PAT (n=75) had significantly fewer maltreatment reports than White families not in PAT (n=75) (3.6% v. 14.7%, $p < .01$). The final category included families in more than one racial group or who identified in another race. These include Asian, American Indian or Alaskan Native, Native Hawaiian, Guamanian or Chamorro, Samoa, or from another Pacific Island. Those in PAT (n=12) had significantly fewer Medicaid-paid child emergency department visits than similar children not in PAT (n=9) (0.4 v. 4.9, $p < .01$).

Outcomes by Other Family Characteristics

Next, we conducted stratified analyses for eight family characteristics, considering the effect of PAT on the 12 family outcomes for each characteristic. Exhibit 3 shows the subgroups with significant findings for each of the characteristics. All significant findings were in the positive direction, indicating PAT families in the listed subgroups improved on the outcome compared to similar families not receiving PAT.

The degree of maternal psychological resources was most predictive of outcomes, with significant differences related to eight of the 12 outcomes. Among mothers who were at or below the median of psychological resources, PAT had significant differences for two parenting outcomes and one child maltreatment outcome. While for those above the median for psychological resources, PAT families showed significant outcomes across four domains including family economic self-sufficiency, parenting, child maltreatment, and child health compared to similar families not receiving PAT.

Level of maternal education was the second most predictive of outcomes, significantly related to seven of the 12 outcomes. For mothers with less than a high school education, those in PAT experienced significant improvements in outcomes related to family economic self-sufficiency, parenting, and child development relative to non-PAT mothers with less than a high school education. PAT had significant impacts in a broader range of outcome domains among mothers with

at least a high school diploma including family economic self-sufficiency, child maltreatment, child health, and child development. IPV was least related to the outcomes, linked to significant differences for only three of the 12 outcomes.

We also looked across the characteristics for each outcome. The outcome of a decrease in any child maltreatment report was significantly related to all family characteristics tested, except for the mother’s IPV status at study entry. On the other hand, the outcome use of nonparental child care was significantly related to only two family characteristics, the smallest across the twelve outcomes.

Outcomes for the Curricula

As PAT’s Foundational Curricula is used optionally across home visiting models, it is possible the curricula itself is related to some family outcomes, independent of the full PAT model. We used two samples to better understand the impact of the Foundational Curricula. The first sample included a treatment group of families who 1) received at least 3 months of home visiting; 2) participated in any home visiting model; and 3) were served by a program that indicated using PAT Foundational Curricula with all families. This yielded 371 in treatment group 1 and 355 in a matched comparison group. For the second sample, the treatment group used the same criteria as the first but was limited to just those in a PAT program. This yielded 201 in treatment group 2 and 205 in its matched comparison group. Note that treatment group 2 is a subsample of treatment group 1. The two samples give some insight into whether the outcomes might be related to the curricula or to the model. For this research question, we looked at all 67 MIHOPE outcomes as we did in research question 1. Exhibit 4 summarizes significant outcomes for each treatment group. Four outcomes were significant for both treatment groups, suggesting these outcomes are more likely to be related to the Foundational Curricula rather than to other features of the home visiting models.

Exhibit 4. Significant Outcomes for Families Receiving PAT Foundational Curricula

Family Outcomes	Treatment Group 1 (All models)	Treatment Group 2 (PAT programs)
Outcomes for Both Treatment Groups		
Child Development		
Behavior during a parent-directed task: Distress	✓*	✓*
Child Maltreatment		
Any maltreatment report	✓ ^x	✓**
Family Economic Self-Sufficiency		
Use of nonparental child care	✓*	✓*
Parenting		
Awareness of health and safety hazards	✓ ^x	✓*

Family Outcomes	Treatment Group 1 (All models)	Treatment Group 2 (PAT programs)
Outcomes for Only One Treatment Group		
Child Development		
Behavior problems		✓X
Receptive language skills		✓*
<i>Behavior during semi-structured play with the parent</i>		
Negativity toward the parent		✓X
Sustained attention to objects		✓X
<i>Behavior during a parent-directed task</i>		
Compliance		✓X
Child Health		
Any Medicaid-paid health care encounter for injury or ingestion		✓*
Number of Medicaid-paid child emergency department visits	✓X	
At risk of overweight	✓X	
Duration of breastfeeding (months)	✓X	
Family Economic Self-Sufficiency		
Receiving education or training		✓*
<i>Received any public assistance during the past month</i>		
Supplemental Nutrition Assistance Program		✓X
Women, Infants, and Children	✓*	
Intimate Partner Violence		
Maternal experience with physical or sexual violence	✓X	
Maternal experience with battering	✓**	
Maternal Health		
Health insurance coverage for the mother	✓X	
Parenting		
Quality of the home environment	✓*	
<i>Quality of the home environment</i>		
Parental warmth	✓X	
<i>Parental supportiveness</i>		
Sensitivity		✓*
<i>Parental Discipline</i>		
Gentle guidance	✓*	
Control		✓*
<i>Parental stress</i>		
Parent-child dysfunctional interaction	✓*	

Notes:

- × p ≤ .1
- * p ≤ .05
- ** p ≤ .01
- *** p ≤ .001

In the Child Development domain, children in both treatment groups of families receiving the PAT Foundational Curricula showed significantly less child distress during a parent directed task than their comparison groups. MIHOPE defines distress as the degree to which the child shows frustration, anger, or signs of being upset during a clean-up task (Michalopoulos et al., 2019). Child's distress is measured with a 4-point scale, with higher values indicating greater distress. Families receiving the Foundational Curricula in treatment group 1 scored a mean of 1.7 on the distress scale, relative to 1.9 for the comparison group ($p < .05$). The same results (means and p-value) emerged when the sample was limited to those using the Foundational Curricula in PAT programs (treatment group 2 and matched comparison). Since this finding was significant for both treatment groups, this suggests the curriculum itself may have impacted the outcome. There were several other child development outcomes that were statistically significant for one PAT curricula sample treatment group but not the other, which may suggest there are other components of the models rather than the curricula that explain the outcomes (e.g., home visitor education, frequency of home visits).

In the Child Maltreatment domain, families in both treatment groups receiving the PAT curricula were less likely to have any maltreatment reports than their comparison groups. Again, this finding suggests the curricula may have influenced this outcome. Families across the home visiting models using PAT Foundational Curricula (treatment group 1) had significantly less child maltreatment reports than their comparison group (7.8% v. 11.8%, $p < .1$). And families in PAT programs using Foundational Curricula (treatment group 2) were even less likely to have a maltreatment report relative to their comparison group (6.1% v. 12.4%, $p < .01$).

In the Parenting domain, having a greater awareness of health and safety hazards was statistically significant across both treatment groups relative to their comparison groups, indicating that perhaps the curriculum itself positively impacted the outcome. Families in treatment group 1 averaged 3.7, in contrast to their comparison group averaging 3.5 ($p < .1$), and families in treatment group 2 yielded similar results relative to their comparison group (3.7 v. 3.4, $p < .05$). There were also a few other significant outcomes for one sample or the other in the parenting domain, but not for both.

Lastly, in the Family Economic Self-Sufficiency domain, families receiving the Foundational Curricula in both treatment groups were more likely to use nonparental childcare at the 15-month follow up than families in their comparison groups (treatment group 1: 50.7% v. 40.8%, $p < .05$ and treatment group 2: 42.7% v. 30.4%, $p < .05$).

Discussion

Assessment of MIHOPE Findings

MIHOPE's use of the ITT approach in the original analysis followed widely held standards of rigor (What Works Clearinghouse, 2022). From a more practical perspective, however, ITT can underestimate program impact, providing a limited understanding on how participating families may benefit. When decision makers—ranging from policy makers to government administrators to local program directors and their boards—are charged with allocating limited resources to maximize outcomes for families, having more comprehensive knowledge of the range of likely program impacts can lead to better informed and targeted decisions. This analysis provides a more comprehensive perspective on the range of outcomes families in PAT are likely to experience.

Of the 57 outcomes tested at the model level, MIHOPE originally found six statistically significant positive outcomes for PAT families. All of these outcomes were limited to only two of seven outcome domains, namely Parenting and Child Development. MIHOPE also found statistically significant negative family outcomes in child health, with children in PAT at lower risk for normal weight and higher risk for being overweight. In this new analysis when we limit the treatment group to those who received at least three months of PAT, we identified outcomes across a broader range of domains—five of the seven studied—including Family Economic Self-sufficiency, Parenting, Child Maltreatment, Child Health, and Child Development. We found 12 statistically significant family outcomes across the 67 studied. With a p value of .1, then 10% or 6.7 of the 67 outcomes could be found to have a significant difference at random rather than a true difference. While PAT did not show an impact on a large proportion of the outcomes studied, those found positive far exceed the threshold of random findings, suggesting the program did indeed have true impact for participants. As such, these findings suggest PAT may have a more comprehensive effect on key facets of daily life for young children and their families that form the foundation for children's long term well-being.

Assessment of PAT's Intended Outcomes

The PAT National Center has identified seven intended program outcomes outlined in section 1.1. The MIHOPE original analysis found evidence for one of those intended outcomes, namely increasing parent knowledge of early childhood development and improving positive parenting practices. This new analysis limiting the treatment group to those with at least three months of PAT also found evidence supporting the parenting knowledge and practice outcome as well as three additional intended outcomes, including improve parent, child and family health and well-being; prevent child abuse and neglect; and improve family economic well-being. MIHOPE did not measure PAT National Center's other three intended outcomes. One of those, however, increase children's school readiness and success, will be assessed in the MIHOPE Long-Term Follow-Up project and

MIHOPE Elementary School follow-up project currently underway. As both follow up studies will continue to assess the original treatment group, including the 21% assigned to PAT who did not receive any PAT, it is possible the follow up findings could also be an underestimate of the impact of PAT on school readiness and other outcomes for children and families.

When we consider the updated PAT Foundational Curricula which the PAT National Center designed to support the intended outcomes in section 1.1, we found evidence for the intended outcomes related to parenting knowledge and behaviors, child maltreatment prevention, and family economic well-being. There is also evidence suggesting the curricula's positive impact on child development. These findings are highly aligned with the major sections of the curricula including: child development (e.g., what to expect across each age range and developmental concerns), parenting behaviors (e.g., touch and nonverbal communication), parent-child interaction (e.g., activities for parent and child across each age range), development-centered parenting (e.g., attachment, discipline, safety, sleep, nutrition), and family well-being (e.g., parental education and employment, mental health, recreation). On the other hand, the curricula also covers topics related to some certain outcomes assessed for which families receiving the PAT Foundational Curricula did not show a significant difference relative to the comparison group (e.g., other child development and parenting outcomes).

Implications of Subgroup Analyses

It is essential to disaggregate data to begin to understand for whom PAT works and how. Stratifying on race and ethnicity, we find that each racial/ethnic group had at least one unique outcome not found for the other groups. Black families in PAT experienced the greatest number of significant outcomes compared to similar families not in PAT. Yet even Black families only experienced significant improvement in three of the twelve assessed outcomes relative to the comparison group. Since more outcomes are established when we consider all PAT families, we know that some members in each racial/ethnic group experience each of those outcomes. It is possible more outcomes would be statistically significant in the subgroup analyses if the samples were larger. It is also possible that measurement bias—whether unintentionally built into the measures or administrative data sources (e.g., structural racism in child maltreatment reporting system), or potential implicit bias of observers (e.g., cultural expectations among coders of parent-child interaction videos)—may impair the data's ability to show the full extent of behavior change. It is also feasible that the relatively small number of significant outcomes that emerge when we stratify by race/ethnicity suggests that other characteristics besides race/ethnicity are more related to outcomes.

In fact, when we stratify by other family characteristics (research question 3) we see more significant findings among certain characteristics. Findings across the additional eight family characteristics we

assessed suggest that PAT can achieve different outcomes for different types of families. These findings could inform program selection for funders or communities wanting to prioritize certain populations, or for community organizations wanting to triage or match families into services that would be most beneficial for them based on their characteristics. For instance, decision makers wanting to provide services to parents with less than a high school education, may want to fund PAT if they particularly seek to promote parenting practices and child development for these families. For parents who have experienced IPV, on the other hand, fewer outcomes might be expected. Likewise, PAT may use these findings to consider how to tailor the program to better support those families who experienced fewer outcomes.

The current analysis is restricted to considering one family characteristic at a time. It is possible that studying the intersection of multiple characteristics (e.g., Latinas who are first-time mothers with a high school education) could better illuminate more precisely who will benefit from PAT in which specific ways. The sample sizes for the current study would likely not be sufficient to support this type of stratified analysis, though using interaction terms in a non-stratified analysis may be revealing.

Limitations

Although PSM is noted for achieving results similar to an RCT, this is only true when researchers adequately match on all confounders to address self-selection bias (McCombs-Thornton & Poes, 2021). MIHOPE collected a comprehensive array of family characteristics at baseline, supporting a robust matching algorithm. It is possible, however, that the omission of one or more unobserved characteristics yields results with some bias. Our models, for instance, do not account for community context (e.g., other available services, economic resources) or extended family indicators (e.g., the parent's own childhood experiences) that may influence family willingness to opt into a program and continue for at least three months. Community context may also particularly impact certain family outcomes related to family self-sufficiency (e.g., cost of adult education, job availability), maternal health (e.g., Medicaid eligibility criteria), and child maltreatment (e.g., degree of structural racism in reporting system).

While MIHOPE data has sufficient power, our analysis stratifies the treatment group into subgroups. This is essential to begin to understand how PAT works for families in each racial and ethnic group as well as for a variety of other family characteristics. As we stratify, however, the sample sizes become smaller. It is possible that more outcomes would be statistically significant for PAT families in some subgroups if the sample size were larger.

We also do not have a precise measure of program dosage. MIHOPE data provides information on how many visits families received during the 12 months before the follow-up survey. But as follow-up was at 15 months, we do not have data on how many visits families received during the first three

months of program participation. Limiting the study to those with at least three months of PAT, does not adequately describe how many visits families received, whether they received them at the time periods or frequency that PAT recommends, nor what the home visitor and family discussed at each session. As such, this study is not able to shed light on how much PAT is needed to yield each result.

Conclusion

MIHOPE provides a comprehensive assessment of home visiting in the United States. Using an ITT approach, MIHOPE likely underestimates the impact of home visiting. For instance, 21% of MIHOPE families assigned to PAT did not actually receive any home visiting, yet they were included in the PAT treatment group for analysis. Our analysis limits the treatment group to those who received at least three months of PAT, using PSM to create a well-matched comparison group. Limiting the treatment group in this way—while still controlling for selection bias—shows PAT produces a more robust set of family outcomes across five domains. Policy makers and others charged with allocating resources on behalf of children and families can use these results to make better informed decisions on which types of outcomes PAT can yield in general and for specific subgroups of family characteristics. Similar analyses for other home visiting models are warranted to provide a more complete understanding of home visiting outcomes.

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