



Is the Whole Greater than the Sum of Its Parts? Impacts on Child Outcomes from a Home-Visiting Parenting Program and its Interaction with Preschool

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Accepted: 25 June 2024

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Abstract

This study evaluates the effects of a weekly home-visiting parenting program designed to enhance parent-child engagement with educationally-enriching activities and its potential interaction with children's participation in state-funded preschool. Utilizing a comprehensive dataset linked across various administrative sources, we employed a quasi-experimental approach featuring inverse probability weighting regression adjustment and nearest neighbor matching to assess outcomes as measured at or leading up to kindergarten entry. We focused on a cohort of 2,000 diverse children born between 2012 and 2016, aged three and four at the intervention's onset. Participation in the home-visiting program was associated with significant positive effects on children's cognitive skills, IDEA Part B service uptake, and the likelihood of reported child maltreatment, which persisted after adjusting for state-funded preschool participation. We found no statistical evidence of interactions between the program and preschool, underscoring the program's additive contributions to early childhood development and family well-being.

Keywords Home-visiting · Parenting · Early childhood development · Child maltreatment · Cognitive skills · Special education

Introduction

Evidence highlighting the crucial link between early investments in children and subsequent outcomes (e.g., Almond et al., 2018; Duncan et al., 2010; Yoshikawa et al., 2013) has spurred attention to the nature and delivery systems of those investments (e.g., Britto et al., 2017; Duncan et al., 2023a; Francesconi & Heckman, 2016; Kalil, 2014). Recent research underscores the effectiveness of home-visiting programs focusing on parenting and early childhood development in low-income settings globally (e.g., Araujo et al., 2021; Attanasio et al., 2022; Doyle, 2022; Dupas et al., 2023; Emmers et al., 2021; McCormick et al., 2020; Morris

et al., 2017). To illustrate, a recent meta-analysis (Jeong et al., 2021) encompassing 102 randomized controlled trials of parenting interventions across 33 countries, serving families with children aged 3 or under, estimated positive impacts (lower bounds of pooled effect sizes ranging from 0.1 to 0.3) on various measures. These measures included parenting knowledge and practices, parent-child interactions, as well as the child's early cognitive, language, and motor skills, socioemotional development, and attachment.

By contrast, a meta-analysis by Grindal and colleagues (2016), focusing on parenting education services in the U.S., found little overall value-added from such initiatives on children's cognitive skills, beyond the effects generated by preschool programs. Nevertheless, positive and larger effects were observed when programs included frequent home visits frequent (e.g., one or more home visits per month) and specifically targeted the practice of parenting skills. Additionally, re-analyzing the randomized evaluation Head Start Impact Study, Gelber and Isen showed that Head Start's impact on parental involvement was meaningful,

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persisting, and positively associated with impacts on children's cognitive skills (Gelber & Isen, 2013).

In high-income country settings, families with young children typically are exposed to various options for early care and education arrangements, and analyses of the impact of home-visiting parenting interventions would need to consider other type of early investments (Feller et al., 2016; Kline & Walters, 2016). Combinations of services, such as home-visits coupled with preschool participation, and exploration of counterfactual scenarios (e.g., informal care versus parental care versus preschool) could introduce variations in program impacts and contribute to explaining some of the documented mixed results (e.g., as recently reported in Michalopoulos et al., 2019; for an instance of a health intervention acting as a substitute of preschool, see Rossin-Slater & Wüst, 2020).

In general, this literature suggests two main themes. Firstly, more nuanced interpretations of the results are needed due to the heterogeneity of impacts; results that are likely related to program characteristics and contexts (Duncan et al., 2023a; Howard & Brooks-Gunn, 2009; Jervis et al., 2023; Sweet & Appelbaum, 2004). Secondly, it highlights that home-visiting programs, incorporating a responsive-caregiving component, exhibit more meaningful effects on child outcomes compared to programs lacking this element (Jeong et al., 2021; for a comprehensive review, see Britto et al., 2017). The recognition of responsive caregiving as a pivotal mechanism in the success of home-visiting programs holds policy significance. Indeed, with relevant consideration of local contexts (Grantham-McGregor & Walker, 2023), implementing scaled interventions that target nurturing parent-child interactions could prove to have impressive benefit-to-cost ratios that offer long-term returns akin to iconic early childhood interventions like the Perry Preschool Program or the Abecedarian Project (García & Heckman, 2023).

Three hypotheses can be proposed to explain the heterogeneous findings described above. The first hypothesis suggests that early inputs act as substitutes. For instance, gains generated by an intervention on early literacy might be fully compensated by kindergarten attendance for children in the control group (e.g., Dearing et al., 2009; Vernon-Feagans & Bratsch-Hines, 2013), with evidence of compensation manifesting as a negative interaction between the two investments (e.g., Bailey et al., 2020). By contrast, a second hypothesis posits that early inputs act independently, such that their impacts are additive, and interaction estimates are not meaningful (e.g., Carr et al., 2019; Currie & Almond, 2011; Simonsmeier et al., 2022). Finally, a third hypothesis posits that early inputs lead to multiplier effects, where one investment provides a greater yield when gains are also observed from another investment (Johnson & Jackson,

2019). This synergistic effect is identified by a positive interaction between investments such that their combined impact exceeds the sum of each impact considered separately. The present study aimed to test these hypotheses in the context of a weekly home-visiting program targeting the responsive and instructional skills of parents with preschool-aged children. The study estimated the impacts of the home-visiting parenting program on various child outcomes and examined interactions between the effects of the home-visiting program and the effects of the state-funded preschool program.

Parenting and Early Skill Development

Variations in social, cultural, and economic conditions can potentially lead to variations in parent-child interactions and children's early skill formation. For instance, parents and caregivers who are unemployed, underemployed, or without family supports like paid leave and healthcare are likely to experience stressors that can interfere with parenting. And children who are provided opportunities to engage in hands-on learning, shared book reading, or enriching educational interactions (with parents and other caregivers) are more likely to develop a set of skills that prepare them better for formal schooling than children who have not had those regular experiences (e.g., Merz et al., 2015; Mistry et al., 2010; Wade et al., 2018).

Home-visiting parenting programs typically provide parents with education about child development and guidance on beneficial parenting practices (Duncan et al., 2023a; Michalopoulos et al., 2019). They aim to support responsive caregiving, developmentally appropriate expectations, and environment-person transactions that induce favorable timely effects on child's development (e.g., Bornstein et al., 2020; Briley et al., 2014; Cunha et al., 2023; Masek et al., 2021). While any given transaction is context- and domain-specific, as when, for example, parenting's influences on a child's math skill originates from math-related parent-child interactions (Daucourt et al., 2021), successful parenting programs tend to shift "business-as-usual" parental preferences and investments as a whole (e.g., parent-child time allocation, parental beliefs, and caregiving practice; see Bono et al., 2016; Carneiro et al., 2019; Cunha et al., 2013; Fiorini & Keane, 2014). One could then expect early home-visiting parenting programs to generate family-level changes that are durable and general (Fraley et al., 2013), as evidenced by the breadth and persistence of effects stemming from variations in early parental sensitivity or home environments (e.g., Cooke et al., 2022; Duncan et al., 2023b; García & Heckman, 2023; Madigan et al., 2019; Tamis-LeMonda et al., 2019).

Impacts of early responsive caregiving on child affective and cognitive development have a longstanding research

record. Theory posits that learning might be optimal when a sensitive caregiver gauges a child's interests and cognitive level, offering inputs within the bounds of Vygotsky's zone of proximal development, which marks the distance between a child's actual and next developmental level (Vygotsky, 1978). Responsive caregiving thus establishes a norm of contingent reciprocity, i.e., "serve-and-return" interactions (see, Shonkoff & Bales, 2011), where inputs are initiated or responded to by both child and caregiver. Environments that are rich of early sensitive serve-and-return experiences are deemed crucial for a child's developing affective and cognitive capacity, language development, and learning (e.g., Bernard et al., 2013; Ferjan Ramírez et al., 2020; Tomasello et al., 2005).

Home Instruction for Parents of Preschool Youngsters (HIPPY)

The Home Instruction for Parents of Preschool Youngsters (HIPPY) program offered an ideal environment for assessing the effects of a "serve-and-return" parenting intervention.

HIPPY's mission is partnering with parents to prepare their preschool-aged children for success in school (HIPPY United States, 2024). The program supports parents as their children's first teachers by providing them the tools, skills, and confidence to share academic-related activities with their young children in the home. HIPPY currently operates in 15 countries and is delivered in seven languages. In the United States, the program is delivered by almost 130 sites in 20 states. HIPPY is an approved home visiting model of the Federal Department of Health and Human Services' Home Visiting Evidence of Effectiveness (Department of Health and Human Services, 2024).

The HIPPY curriculum consists of an evidence-based and developmentally appropriate sequence of educationally enriching activities, scripted for parents with children ages two to five within a "serve and return" framework. During each weekly visit, parents are trained on delivering a packet of five activities addressing different learning domains, along with related books and raw materials needed to engage their children between 15 and 30 min each day. Parents or legal guardians will have enacted up to 150 playful learning activities and read hundreds of books together with their child, each year they participate in the program (HIPPY United States, 2024).

HIPPY home visitors are typically recruited among current or former participating parents who are members of the communities they aim to serve. A HIPPY home-visit consists of a home visitor and a parent or caregiver spending at least 45 min together, reviewing the previous week's activity packet, and role-playing the five activities for the upcoming week. Additionally, parents will have developed

a social network of support during group meetings, received information on positive child development features (e.g., on establishing a space and time for shared academic-oriented activities), and tips on how to communicate with teachers and navigate school institutions (HIPPY United States, 2024).

There is some evidence that the HIPPY model helps parents build self-efficacy as their children's teachers (Nathans et al., 2020; Nievar et al., 2011). Earlier evaluations of the program reported mixed results regarding child outcomes (Baker et al., 1999). However, a recent larger-sample study found that the odds of passing a state kindergarten-readiness screener were 1.6 times greater and the odds of being promoted to first grade were five times greater for children who participated in the program compared to those who did not (Payne et al., 2020). Correlational studies also found associations between HIPPY participation and academic achievement in the early grades (Abdulaziz, 2022; Nievar et al., 2018).

The Present Study

The current investigation assesses the impact of HIPPY on the early developmental outcomes of children from predominately low-income families in Florida. By leveraging diverse administrative data sources, a quasi-experimental methodology was adopted, integrating both weighting and matching strategies to mitigate the influence of unobservable selection biases. The study concentrated on three key outcomes: performance on the Kindergarten Readiness Screener; the propensity to engage with services provided under the Individuals with Disabilities Education Act (IDEA) Part B plan; and the likelihood of documented instances of child maltreatment. For each outcome, we determined the average effects of HIPPY on the participating families (treatment effects on the treated) and then analyzed these effects in conjunction with those associated with preschool attendance. Our analysis not only delineated the principal effects of HIPPY on child development but also explored the interactive effects, assessing whether simultaneous participation in both HIPPY and preschool programs produced a synergistic impact greater than the aggregate effect of each program individually.

Preschool Environment

Launched in 2005, the Voluntary Prekindergarten (VPK) program in Florida is a statewide initiative that guarantees every child aged four access to at least 540 h of free-of-charge, structured education per academic year, equating to three hours per school day. This program is designed around a curriculum that emphasizes early literacy and

math skills, aiming to adequately prepare children for kindergarten. Managed by the Division of Early Learning, part of the Florida Department of Education, the Voluntary Prekindergarten (VPK) program is offered in both public and private settings. This initiative aims for the enhancement of early childhood education and the promotion of equitable access to essential foundational learning experiences for all children across the state (Florida Department of Education, Division of Early Learning, 2021).

Table 1 Descriptive statistics for the overall sample, HIPPY and comparison groups

	Overall sample	HIPPY group	Comparison group	Wald test <i>p</i> -values
Cognitive skills (Kindergarten readiness screener scores)	520 [108]	513 [107]	520 [109]	0.0044
IDEA plan (part B) in Kindergarten	8.98	17.70	8.89	<0.0001
Child maltreatment by Kindergarten	14.71	17.30	14.51	0.0004
Preschool participation (VPK)	57.18	57.90	57.01	0.4214
<i>Mother characteristics</i>				
College graduate	22.99	17.25	22.97	<0.0001
Did not graduate from high school	14.39	15.70	14.53	0.1399
Age at child's birth (in yrs.)	28.06 [5.89]	27.40 [5.98]	28.10 [5.90]	<0.0001
<i>Race/ethnicity:</i>				
Black	21.70	35.31	22.71	<0.0001
White	47.81	29.77	45.50	<0.0001
Hispanic	25.67	31.71	26.94	<0.0001
Other	4.83	3.25	4.88	0.0007
Born outside of U.S.	26.38	31.10	27.54	0.0004
Married	50.37	34.97	49.89	<0.0001
Prenatal WIC	53.18	72.50	53.55	<0.0001
<i>Child characteristics</i>				
Low birth weight (<2,500 gr)	7.98	9.51	8.01	0.0182
Gender (female)	48.50	48.49	48.25	0.8285
First born	39.37	37.35	39.47	0.0531
IDEA plan (part B) in preschool	6.88	14.81	6.85	<0.0001
<i>Family characteristics</i>				
Medicaid	64.88	83.81	65.08	<0.0001
SNAP	58.86	79.60	59.20	<0.0001
TCA	11.14	18.69	11.19	<0.0001
<i>N</i> children	574,763	2,000	526,145	

Notes HIPPY: Home Instruction for Parents of Preschool Youngsters. Wald test *p*-values refer to test of mean or proportion differences between the HIPPY group and the comparison group. Standard deviation for continuous variables are in brackets. IDEA: Individuals with Disabilities Education Act; WIC: Women, Infant, and Children program; SNAP: Supplemental Nutrition Assistance Program; TCA: Temporary Cash Assistance. All sampled children were born in the state of Florida

Method

Data and Sample

Our dataset integrates information from several Florida state agencies and departments by utilizing children's Social Security Numbers (SSN) for initial data linkage. When exact SSN matches were not possible or SSNs were unavailable, we employed alternative record linkage techniques based on a combination of children's first and last names, birth month, gender, and either seven or eight digits of their SSN or at least two of the following identifiers: birth day, birth year, and middle initial. This comprehensive dataset includes vital statistics from birth certificates, Medicaid eligibility records from both the Department of Health and the Agency for Health Care Administration (DOH/AHCA), and information on kindergarten test scores, participation in the Individuals with Disabilities Education Act (IDEA) Part B plan, and the Voluntary Prekindergarten (VPK) program from the Department of Education and the Division of Early Learning (DOE/DEL). Additionally, it encompasses records of child maltreatment, participation in the Supplementary Nutrition Assistance Program (SNAP), and Temporary Cash Assistance (TCA) from the Department of Children and Families (DCF), along with data on participation in the Home Instruction for Parents of Preschool Youngsters (HIPPY) program, provided by the University of South Florida.

Our total sample size ($N=574,763$) includes families participating in HIPPY and other families for whom data was linked. The birth cohorts of children in our sample range from 2011 to 2016. On average, children participating in HIPPY were about 4 years old and were typically enrolled in the program for at least one year. While we had complete data across all measured outcomes and covariates for HIPPY participants ($n=2,000$), we derived a comparison group from the broader sample by focusing on those with complete data sets ($n=526,145$).

Table 1 outlines the descriptive statistics regarding outcomes and background characteristics for the full sample, HIPPY participants, and the comparison group. Although the overall sample and comparison group showed nearly identical statistics, marked distinctions were evident between HIPPY participants and the comparison group. HIPPY mothers were more likely to not have a college degree or be unmarried at the time of their child's birth and were more often beneficiaries of means-tested programs such as Women, Infant, and Children (WIC), Medicaid, Supplemental Nutrition Assistance Program (SNAP), and Temporary Cash Assistance (TCA). A higher proportion of HIPPY families identified with historically marginalized minority groups (35% and 32% identified as Black or

Hispanic, respectively, compared to 23% and 27% in the comparison group). About 15% of children in the HIPPY program utilized special education services in preschool (IDEA), as opposed to around 7% in the comparison group. We also noted that the rate of preschool participation (VPK) was virtually the same between the HIPPY group and the comparison group, at about 57–58%.

Outcomes Considered

As previously indicated, our investigation centered on three primary outcomes, detailed in the initial rows of Table 1.

Cognitive Skills

This outcome is based on Florida’s kindergarten readiness screener, the Renaissance STAR early literacy and numeracy assessment, administered within the first 30 days of kindergarten entry. Ranging from 300 to 900, scores of 500 or above are indicative of “kindergarten ready” (Florida Department of Education, 2022). This computer-adaptive assessment evaluates a variety of skills and knowledge across domains including the alphabetic principle, concept of word, visual discrimination, phonemic awareness, phonics, vocabulary, and early numeracy. There is evidence that kindergarten STAR assessment scores are associated with early developmental and behavioral screenings (Schlichting et al., 2023). The assessment demonstrates adequate reliability, strong internal consistency, along with moderate concurrent and predictive validity (Clemens et al., 2015; Hadley et al., 2023; McBride et al., 2010). In our sample, descriptive analysis revealed a statistically significant but relatively small mean difference between the groups, with the HIPPY group scoring an average of 7 raw points lower than the comparison group (Cohen’s $d=0.07$; $p=.004$).

IDEA Services

Defined as a binary indicator for participation in kindergarten services such as special education, physical, occupational, and speech therapy, as well as supplementary aids or services, under the Individuals with Disabilities Education Act (IDEA) Part B (Centers for Disease Control & Prevention, 2018). Approximately 18% of children in the HIPPY group utilized IDEA services, compared to about 9% in the comparison group (mean group difference: 9%; $p < .0001$).

Child Maltreatment

Defined as a binary indicator for the occurrence of one or more reported instances of child maltreatment during the

HIPPY participation period, substantiated by credible evidence upon investigation (Florida Department of Children & Families, 2020). Reports of child maltreatment were observed in approximately 17% of HIPPY families compared to about 15% in the comparison group (mean group difference: 2%; $p=.0004$).

In summary, families participating in the HIPPY program were observed to be more disadvantaged across both covariates and the outcomes considered. Given these findings, it is crucial to employ a quasi-experimental design, which will be detailed in the following section, aiming to achieve balance between the participants in the HIPPY program (the treatment group) and the pool of individuals in the comparison group. This approach is necessary to account for key baseline characteristics that may influence selection into the program or affect outcomes.

Empirical Strategy

In evaluating the impact of HIPPY, the potential outcomes framework, also known as the Rubin causal model, anchors our empirical strategy (Angrist & Pischke, 2009). This approach posits two potential states for each individual: one if the individual participates in HIPPY, and one if they do not. Yet, only one of these outcomes is observable for any individual, leaving the counterfactual outcome hypothetical. Central to our analysis is the Average Treatment Effect on the Treated (ATET), which provides an estimation of the program’s impact specifically on its recipients. It is formally represented as

$$ATET = E(y_1 - y_0 | t = 1)$$

where y_1 is the outcome if the individual participates in HIPPY, y_0 is the outcome if they do not participate, and $t = 1$ identifies individuals who participate in the program.

To compute ATET, we utilized both an Inverse Probability Weighting Regression Adjustment (IPWRA) and a nearest-neighbor matching technique. IPWRA mitigates potential selection biases by applying weights inversely proportional to the likelihood of receiving the treatment. The estimator is “doubly robust” as it remains consistent if either the model for the treatment assignment (propensity score model) or the model for the outcome (regression model) is correctly specified, but not necessarily both, making it a reliable tool for our analysis (Wooldridge, 2007). Nearest-neighbor matching complements the previous technique by pairing each treated individual with one or more untreated individuals who are similar in observed characteristics (Abadie et al., 2004), effectively reducing the analytic subsample size but enhancing the comparability between treated and untreated groups, making it a valuable part of

Table 2 Covariate balance summary between the HIPPY group and the comparison group ($N=510,670$)

	Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted
SNAP	0.44	0.02	0.67	0.97
Medicaid	0.43	0.02	0.59	0.97
TCA	0.20	0.00	1.49	1.02
<i>Mother characteristics:</i>				
Age	-0.11	-0.01	1.92	1.01
Prenatal WIC	0.38	0.02	0.80	0.99
College graduate	-0.15	0.00	0.80	1.00
Not high school graduate	0.02	-0.01	1.05	0.97
Married	-0.30	-0.02	0.90	0.99
Born outside of U.S.	0.07	-0.01	1.06	0.99
Black	0.27	0.01	1.28	1.01
Hispanic	0.08	-0.01	1.08	0.99
<i>Child characteristics:</i>				
Low birth weight	0.05	0.00	1.15	1.01
Gender (female)	-0.01	0.00	1.00	1.00
First born	-0.04	0.00	0.98	1.00
IDEA in preschool	0.25	0.00	1.94	1.01

Notes HIPPY: Home Instruction for Parents of Preschool Youngsters. SNAP: Supplemental Nutrition Assistance Program; TCA: Temporary Cash Assistance; WIC: Women, Infant, and Children program; IDEA: Individuals with Disabilities Education Act

our empirical strategy. By integrating IPWRA and nearest-neighbor matching, we leverage both a model-based and a direct comparison methodology.

We employed the *teffects* routines in Stata 17 to conduct the Inverse Probability Weighting Regression Adjustment (IPWRA) and nearest-neighbor matching analyses. To explore the interactions between HIPPY and preschool attendance, we applied regression models utilizing the inverse probability weights derived from the IPWRA for further regression adjustments. In addition to balancing our models on covariates, we included fixed-effects for birth cohort, school district, and year of kindergarten-readiness assessment specifically for the cognitive skills outcome model.

We investigated the following research questions:

1. What is the impact of HIPPY on kindergarten readiness, IDEA service uptake, and incidence of child maltreatment?
2. How does preschool attendance affect the impact of HIPPY on kindergarten readiness, IDEA service uptake, and incidence of child maltreatment?
3. What are the direction, magnitude, and significance of the interactions between HIPPY and preschool attendance?

Table 3 HIPPY average treatment effect on the treated (ATET) and HIPPY x Preschool Interaction on cognitive skills

	(1)	(2)	(3)	(4)	(5)
HIPPY	0.07*** [0.03; 0.11]	0.09*** [0.04; 0.14]	0.09*** [0.05; 0.14]	0.06*** [0.02; 0.10]	0.08*** [0.02; 0.14]
Preschool				0.22*** [0.12; 0.32]	0.27*** [0.24; 0.31]
HIPPY x Preschool					-0.04 ($p=.39$)
<i>N</i> children	510,670	4,000	10,000	510,670	510,670

Notes HIPPY: Home Instruction for Parents of Preschool Youngsters. Measures for cognitive skills were obtained from the kindergarten readiness screener scores, normalized to have a mean of zero and standard deviation of one. Models (1) and (2) implement an inverse probability weighting regression-adjustment (IPWRA). Models (2) and (3) implements the Nearest Neighbor matching, with 1 and 4 neighbor(s), respectively. In the IPWRA model (4), the Preschool estimate refers to preschool effect for the HIPPY group. Model (5) implements an inverse probability weighted OLS regression with HIPPY x Preschool interaction. Covariates and fixed effects for school district, birth cohort, and kindergarten readiness screener year of administration were implemented throughout. 95% confidence intervals are in brackets. ***significant at the 1% level

Results

Table 2 presents the covariate balance estimates from the IPWRA model analysis, involving a sample of 510,670 children. The weighted standardized mean differences between the HIPPY participants and the comparison group approached zero, and the variance ratios were close to 1, indicating excellent balance on key characteristics between groups. Nearest-neighbor matching models, utilizing either 1 or 4 matched neighbors (as recommended in Abadie et al., 2004), yielded sample sizes of $n=4,000$ (2,000 in the treatment group and 2,000 in the control group) and $n=10,000$ (2,000 treated and 8,000 control), respectively. Balance estimates for these models were nearly identical to those from the IPWRA model, underscoring the robustness of our covariate balancing approach across different methodologies (see the Online Appendix, Table A.1 & A.2).

The first four columns of Table 3 outline the average treatment effect on the treated (ATET) of the HIPPY program on cognitive skills at the entry to kindergarten. Column (1) presents the IPWRA model's findings, indicating a statistically significant boost of approximately 7% of a standard deviation in cognitive skills due to program participation (95% CI = [0.03; 0.11]). The Nearest Neighbor Matching models, depicted in columns (2) and (3), show a somewhat higher effect size, at 9% of a standard deviation, albeit with slightly broader confidence

intervals. These estimates suggest that HIPPY's impact on cognitive skills is robust across different methodological approaches. Column (4) reveals that including preschool participation marginally adjusts the estimate from model (1) downward, implying that HIPPY's influence operates independently of preschool effects, which themselves contributed a significant increase of about 22% of a standard deviation in cognitive skills among HIPPY participants. The interaction between HIPPY and preschool, presented in column (5), was minor and negative, suggesting a potential compensatory effect, but it was not statistically significant. Consequently, the notion that preschool could serve as a substitute for HIPPY's influence is not strongly supported. Instead, the data favor an additive effect model.

In Table 4, both types of estimators—Inverse Probability Weighting Regression Adjustment and Nearest Neighbor Matching—demonstrated in columns (1) through (3), consistently reveal a significant 2% point increase in IDEA service uptake at kindergarten among HIPPY participants. This increase translates to an effect size of 6% of a standard deviation. The OLS weighted regression model, presented in column (4), confirms HIPPY's sustained impact, with maintained effect size and significance. Preschool attendance appeared not to influence this outcome, showing a negligible change (0.006% points; $p = .61$) and thus, making the interaction estimates in model (5) appear noisy and less informative. The core finding is that participation in the HIPPY program appears to significantly boost the likelihood of IDEA service enrollment for children who had not received such services before kindergarten entry.

Table 5 offers consistent evidence of HIPPY's beneficial impact, as shown across all models (columns 1 to 4). It reveals that, by kindergarten entry, families and children participating in the HIPPY program were about 2% points less likely to be reported for child maltreatment compared to their counterparts in the comparison group. This statistically significant reduction translates into an effect size of approximately 5% of a standard deviation, underscoring HIPPY's role in mitigating risk factors linked to maltreatment or neglect. Model (4)'s analysis on the effect of preschool attendance within HIPPY families indicates a 1% point reduction in maltreatment reports, which, however, did not achieve statistical significance ($p = .50$). This outcome suggests that preschool attendance, in isolation, does not markedly alter the likelihood of maltreatment reports among HIPPY participants. Moreover, the small and positive but non-significant ($p = .39$) interaction effect estimated in model (5) suggests that preschool attendance does not robustly substitute or enhance HIPPY's protective impact against maltreatment.

Table 4 HIPPY average treatment effect on the treated (ATET) and HIPPY x Preschool Interaction on IDEA Uptake

	(1)	(2)	(3)	(4)	(5)
HIPPY	0.02*** [0.01; 0.03]	0.02** [0.004; 0.03]	0.02*** [0.01; 0.03]	0.02*** [0.01; 0.03]	0.01 ($p = .28$)
Preschool				0.01 ($p = .61$)	-0.004 ($p = .28$)
HIPPY x Preschool					0.01 ($p = .33$)
N children	510,670	4,000	10,000	510,670	510,670

Notes HIPPY: Home Instruction for Parents of Preschool Youngsters. IDEA: Individuals with Disabilities Education Act. Models (1) and (2) implement an inverse probability weighting regression-adjustment (IPWRA). Models (2) and (3) implements the Nearest Neighbor matching, with 1 and 4 neighbor(s), respectively. In the IPWRA model (4), the Preschool estimate refers to preschool effect for the HIPPY group. Model (5) implements an inverse probability weighted OLS regression with HIPPY x Preschool interaction. Covariates and fixed effects for school district and birth cohort were implemented throughout. 95% confidence intervals are in brackets. ***significant at the 1% level

Table 5 HIPPY average treatment effect on the treated (ATET) and HIPPY x Preschool Interaction on Maltreatment

	(1)	(2)	(3)	(4)	(5)
HIPPY	-0.02** [-0.03; -0.001]	-0.03*** [-0.04; -0.01]	-0.02** [-0.04; -0.004]	-0.02** [-0.03; -0.001]	-0.02* [-0.05; 0.001]
Preschool				-0.01 ($p = .56$)	-0.03*** [-0.04; -0.01]
HIPPY x Preschool					0.02 ($p = .33$)
N children	510,670	4,000	10,000	510,670	510,670

Notes HIPPY: Home Instruction for Parents of Preschool Youngsters. Models (1) and (2) implement an inverse probability weighting regression-adjustment (IPWRA). Models (2) and (3) implements the Nearest Neighbor matching, with 1 and 4 neighbor(s), respectively. In the IPWRA model (4), the Preschool estimate refers to preschool effect for the HIPPY group. Model (5) implements an inverse probability weighted OLS regression with HIPPY x Preschool interaction. Covariates and fixed effects for school district and birth cohort were implemented throughout. 95% confidence intervals are in brackets. ***significant at the 1% level; ** significant at the 5% level; * at the 10% level

Discussion

In this study, we explored the impacts of the Home Instruction for Parents of Preschool Youngsters (HIPPY) program on cognitive skills, disability-related service uptake, and the occurrence of child maltreatment among families with preschoolers, particularly those of color and those facing resource challenges. We further examined the synergy between HIPPY and preschool attendance by testing three hypotheses: preschool serves as a substitute for HIPPY's impacts; HIPPY's impacts are amplified by preschool participation; and HIPPY's impacts are additive.

Our findings indicate modest yet significant benefits of HIPPY across all examined outcomes. Specifically, HIPPY participation led to a 7% of a standard deviation gain in literacy and numeracy skills at kindergarten entry, corresponding to a 3%-point increase in meeting Florida's kindergarten readiness threshold. Additionally, children in the HIPPY program were more likely to engage in special education services (+2% points) and less likely to be reported for child maltreatment (-2% points) by kindergarten.

The lack of meaningful interaction effects suggests that the impacts of HIPPY and preschool attendance are additive, aligning with existing literature on the benefits derived from state-wide preschool, parenting programs, and subsequent investments (e.g., Carr et al., 2019; Duncan et al., 2023c; Watts et al., 2023). There are a few reasons why the impacts of these two types of early interventions may follow different mechanisms. Firstly, HIPPY operates as a home-visiting program that primarily targets parents, thereby indirectly benefiting children. In contrast, Florida's Voluntary Prekindergarten Program directly engages children within child-care centers or elementary schools. Secondly, while HIPPY includes academic-related activities that may mirror preschool curricula, home visitors place a strong emphasis on fostering parent-child relations, such as contingent reciprocity, the establishment of routines, and cultivating habits of mind. Consequently, although preschool environments provide foundational academic and social skills, HIPPY supplement these effects by enhancing nurturing care practices within the home, which in turn contributes to kindergarten readiness.

HIPPY's positive impact on cognitive skills aligns with findings from other home-visiting parenting programs (e.g., Doyle, 2022; Filene et al., 2013; McCormick et al., 2020; Nix et al., 2018). Its relatively modest effect size, when compared to other parenting interventions, could be attributed to the large size of our sample and the program's broad geographical reach. These smaller estimates likely represent a scaling effect, providing a realistic expectation of the effects HIPPY might achieve at an even larger scale.

The observed increase in special education services uptake during kindergarten following HIPPY participation may be interpreted through two lenses. Firstly, a key component of HIPPY focuses on educating parents about child development milestones and available institutional resources for children with specific needs. This could lead to parents being more aware of their child's developmental path and more effective in navigating administrative and institutional processes. Indeed, a significant portion of children in the HIPPY program who were enrolled in an IDEA plan during kindergarten required speech or language services, needs that were previously unidentified. Although we controlled for preschool-years IDEA uptake, the increased special education uptake in kindergarten could indicate a selection bias

for which our analysis did not account (Steiner et al., 2010). In such scenario, HIPPY's impact on cognitive skills might have potentially been underestimated, as children requiring special education often have lower scores on school readiness tests.

The observed decrease in the likelihood of child maltreatment associated with HIPPY participation underscores the program's potential to strengthen affective and emotional bonds, both between parents and their children and between parents and providers. The former observation is supported by a meta-analysis on the effectiveness of home-visiting programs (Filene et al., 2013; see also, Koop et al., 2022), which identified sensitive and responsive parenting as crucial for positive outcomes across various domains, particularly in maltreatment prevention and cognitive development. This effect is likely more pronounced in contexts of lower socioeconomic status or poverty, where families may encounter a higher frequency of chaotic life events and have limited access to beneficial social capital and support networks (Morris et al., 2017). Additionally, the bonding between parents and providers, is recognized as a critical factor for the successful implementation of any home visiting model (e.g., Riley et al., 2008). Thus, theoretically, HIPPY's intensive visiting schedule and the practice of recruiting former parent participants as home visitors to serve within their communities facilitate the development of an effective working alliance.

Limitations and Future Directions

Two important caveats warrant consideration: firstly, the statistical significance of HIPPY's impact on maltreatment contrasts with its relatively imprecise estimation (confidence interval upper-bound close to zero), necessitating cautious interpretation of this result. Secondly, HIPPY's influence on maltreatment presents a divergence from other studies investigating home-visiting effects on maltreatment, early injuries, and neglect (Matone et al., 2012, 2018), suggesting HIPPY's unique approach may lead to different outcomes compared to other programs. This distinction reinforces the importance of context and program specifics in assessing the effectiveness of home-visiting interventions on child welfare. Additionally, while Florida HIPPY shows promise in enhancing parental self-efficacy and improving child learning outcomes, caution must be exercised in generalizing these findings without careful examination of the specific contexts and populations involved.

In our study, we applied a quasi-experimental methodology to investigate HIPPY, enhancing our confidence that the observed impacts were unbiased. Nevertheless, a second (quasi-)experimental design would have been ideal to more accurately estimate preschool attendance's causal effects

and further minimize confounding variables affecting our interaction effects. Additionally, our analysis lacked information on alternative preschool arrangements for families not participating in Florida's Voluntary Prekindergarten Program. It's also conceivable that the true estimates for the interaction terms might have been too minimal to identify due to insufficient statistical power. Nonetheless, interactions of such slight magnitudes are likely to have minimal practical significance (Sherman & Pashler, 2019).

Given the potential of HIPPPY to significantly improve early caregiving and parent-child relationships, its impacts for the participating children are anticipated to have enduring effects (Roisman & Fraley, 2013). A sustained enhancement of the home environment may trigger a developmental cascade, offering protection against risks (e.g., Hentges et al., 2018) and promoting intellectual growth (e.g., Ahmed et al., 2021; Borairi et al., 2021). Unfortunately, our data limitations precluded exploring these compelling hypotheses, underscoring the need for comprehensive longitudinal studies, especially in the realm of early childhood policy, cost considerations, and scalability.

While an economic analysis of HIPPPY falls outside this study's scope, we propose that targeted parenting programs like HIPPPY are promising avenues for social investment. If HIPPPY effectively bolsters parent-child interactions, it may also mitigate future educational challenges, such as chronic absenteeism or grade retention. Further investigation into long-term school outcomes is recommended. Considering the study's findings on maltreatment prevention and the substantial lifetime costs associated with non-fatal child maltreatment (Peterson et al., 2018), HIPPPY could be cost-effective for the families under consideration, based solely on its maltreatment impact.

Conclusion

The impact of HIPPPY on cognitive skills was substantial and remained significant beyond effects from preschool attendance. Additionally, the program's modest effect in reducing the likelihood of child maltreatment suggests enhanced family dynamics. Furthermore, the increased engagement of HIPPPY families with special education and related services in kindergarten indicates that the program empowers parents to navigate and advocate within educational settings for their children. These findings collectively affirm the pivotal role of HIPPPY in supplementing traditional educational pathways and fostering foundational elements of early childhood development.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10643-024-01720-x>.

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