



# Timeliness of Early Identification and Referral of Infants with Social and Environmental Risks

Rebecca C. Fauth<sup>1</sup> · Chie Kotake<sup>1</sup> · Susan E. Manning<sup>2,3</sup> · Jessica L. Goldberg<sup>1</sup> · M. Ann Easterbrooks<sup>1</sup> · Beth Buxton<sup>2</sup> · Karin Downs<sup>2</sup>

Accepted: 10 October 2022  
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## Abstract

The Early Intervention Parenting Partnerships (EIPP) program is a home visiting program that provides home visits, group services, assessments and screenings, and referrals delivered by a multidisciplinary team to expectant parents and families with infants who experience socioeconomic barriers, emotional and behavioral health challenges, or other stressors. The present study examines whether EIPP successfully meets its aims of screening families for social and environmental factors that may increase the risk of children's developmental delays and connect them to the larger statewide early intervention (EI) system relative to families with similar background characteristics who do not receive EIPP. Coarsened exact matching was used to match EIPP participants who enrolled between 2013 and 2017 to a comparison group of families identified from birth certificates. Primary study outcomes including EI referrals, evaluations, and service receipt for children from 3 months to 3 years were measured using EI program data. Secondary outcomes included EI referral source, EI eligibility criteria (e.g., presence of biological, social, or environmental factors that may increase later risk for developmental delay), and information on service use. Impacts were assessed by fitting weighted regression models adjusted for preterm birth and maternal depression and substance use. EIPP participants were more likely than the comparison group to be referred to, evaluated for, and receive EI services. EIPP facilitated the identification of EI-eligible children who are at risk for developmental delays due to social or environmental factors, such as violence and substance use in the home, child protective services involvement, high levels of parenting stress, and parent chronic illness or disability. EIPP serves as an entry point into the EI system, helping families attain the comprehensive supports they may need to optimize their well-being and enhance children's development.

**Keywords** Home visiting · Early intervention · Child find

The Early Intervention Parenting Partnerships (EIPP) program is a home visiting program administered by the Massachusetts Department of Public Health (MDPH) operating in four Massachusetts communities. Since 2003, EIPP has provided individualized support to pregnant and postpartum parents and families to ensure optimal maternal health,

perinatal outcomes, and child growth and development through the first year of life. One of the aims of EIPP is early identification of families experiencing social and environmental stressors that may increase children's risk for later developmental delays and referral of these families to Early Intervention (EI) services. Social and environmental stressors include factors related to poverty, parent health conditions, involvement in the child welfare system, and substance abuse or violence in the home.

Early identification of potential risks to children's health and development is a critical component of an effective early childhood system of care that promotes health equity and mitigates the damaging and lasting effects of poverty, racism, and other stressors experienced during early childhood (Blair & Raver, 2016; Boone Blanchard et al., 2021). In 2019, 10.5 million children (14.4%) in the U.S. lived in families with incomes below the federal poverty line, with

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✉ Rebecca C. Fauth  
rebecca.fauth@tufts.edu

<sup>1</sup> Tufts Interdisciplinary Evaluation Research (TIER), Eliot-Pearson Department of Child Study and Human Development, Tufts University, 574 Boston Ave., Suite 106, Medford, MA 02155, USA

<sup>2</sup> Massachusetts Department of Public Health, Bureau of Family Health and Nutrition, Boston, USA

<sup>3</sup> Centers for Disease Control and Prevention, Division of Reproductive Health, Atlanta, USA

Black and Hispanic children experiencing disproportionately high poverty rates (25.6% and 20.9%, respectively; Semega et al., 2020). Decades of research document the detrimental influence of poverty (Duncan et al., 2010) and its associated factors, such as involvement with child protective services (Berger & Waldfogel, 2011), mental health challenges (Raskin et al., 2016), substance use disorder (Peleg-Oren & Teichman, 2006), and intimate partner violence (MacMillan & Wathen, 2014) on children's development. Differences in brain development and cognition between children experiencing poverty and their peers tend to appear in the first year of life (Hanson et al., 2013; Shonkoff et al., 2012) and persist into adulthood (Duncan et al., 2010). Providing early access to resources, such as EI, can alter these trajectories toward positive development and thriving (Shonkoff et al., 2012). Yet, research documents the lack of a seamless and coordinated system of support and care for families (Goldberg et al., 2018; Goodman et al., 2019). The present study examines whether EIPP supports families' successful connections to the larger statewide EI system, serving as a key referral resource bridging home visiting during pregnancy and early infancy with EI through the early years. Below we provide an overview of the federally mandated EI system, followed by a description of EIPP.

## Overview of the Federally Mandated EI System

Part C of the Individuals with Disabilities Education Act (IDEA, P.L. 108–446) is a federal grant program that helps states develop and operate comprehensive coordinated systems of EI services for infants and toddlers with disabilities or developmental delays from birth up to 3 years. EI services focus on enhancing young children's physical, cognitive, and socio-emotional development through professional supports and services, including child development, nursing and health, speech and language, occupational and physical therapy, mental health and social work, and nutrition. A key component of part C is the Child Find system, which includes public awareness activities that promote the early identification, referral, and evaluation of potentially eligible infants and toddlers.

Successful Child Find includes identification of children with existing delays, but also those who experience biological, social, or environmental factors that influence their risk for future delays (Council on Children With Disabilities, Section on Developmental Behavioral Pediatrics, Bright Futures Steering Committee, & Medical Home Initiatives for Children With Special Needs Project Advisory Committee, 2006). Many states, including Massachusetts, include biological risk factors such as low birth weight and premature birth in their EI eligibility criteria.

Massachusetts is one of only five states that also provides EI services for children who are at risk for delays due to social and environmental factors including parent chronic illness or disability, inadequate basic resources, an open or confirmed child protective services investigation, and substance abuse or violence in the home (Prenatal-to-3 Policy Impact Center, 2021). Table 1 includes a crosswalk of EI and EIPP eligibility criteria and services.

The goal of Child Find is to identify, refer, and evaluate infants and toddlers who may benefit from EI as early as possible. The American Academy of Pediatrics recommends standardized developmental screening at the 9-, 18-, and 30-month well child visits or when concerns arise through ongoing developmental surveillance (Lipkin & Macias, 2020). Massachusetts has a strong Child Find and EI system. Findings from a nationally representative survey revealed that 41.7% of children under age 3 in Massachusetts received a developmental screening in 2016, compared to 30.4% nationally (Hirai et al., 2018), and nearly 11% received EI services in Massachusetts, compared to about 3.5% nationally (U.S. Department of Education Office of Special Education Programs, 2019). Despite Massachusetts' relative success enrolling children in EI, research suggests that there remains a marked discrepancy between the proportion of EI eligible children (i.e., about 39% of children at 9 months) and the proportion enrolled (Rosenberg et al., 2013).

While Massachusetts has been successful at referring families experiencing biological, social, or environmental factors to EI, data suggest that these families may be getting lost during the evaluation and enrollment process. A pair of older studies in Massachusetts found that while EI referrals were relatively high among families with infants born low birthweight and premature and for mothers who were young or had low educational attainment, referred families did not necessarily get evaluated or receive services, compared to families of infants with established disabilities or conditions (Clements et al., 2006, 2008). Additionally, while Black families were more likely than White families to be referred to EI, they were less likely to be evaluated and no more likely to enroll (Clements et al., 2008).

Several studies have reported barriers to EI evaluations and enrollments. Structural barriers include the absence of systematic EI referral tracking systems as well as providers' lack of knowledge of the full eligibility criteria (Conroy et al., 2018; Little et al., 2015). Families' barriers include a lack of understanding of the purpose of EI or its referral processes, stigma related to having a child with developmental delays, or concern that EI is connected to the child welfare system (Jimenez et al., 2012; Little et al., 2015). These findings suggest that some eligible families may be missing out on important developmental services for their children.

**Table 1** Description of Massachusetts Early Intervention (EI) and Early Intervention Parenting Partnerships (EIPP) Programs Services and Eligibility Criteria

|  | EI   | EIPP   |
|--|--|--|
| Target participant                     | Child but parent participation encouraged  | Parent and child   |
| Child ages served                      | Birth to 3 years   | Prenatal to 1 year   |
| Geographic service area                | Statewide  | Cambridge/Somerville, Fall River, Lowell, and Springfield  |
| Service delivery setting               | Typically in the home or a natural setting   | In the home  |
| Available services (not comprehensive) | Nursing and health, speech and language, occupational and physical therapy, mental health and socialwork, nutrition  | Screening and health assessments; education, brief interventions, and support; referrals and connections   |
| Eligibility criteria                   | <p>At least one of the following child factors:</p> <ul style="list-style-type: none"> <li>Established condition (e.g., neurological, metabolic, or genetic disorder; chromosomal anomaly; vision or hearing loss) or established developmental delay</li> <li>At risk for developmental delay due to 4 or more biological, social, or environmental factors including low birthweight, gestational age &lt; 32 weeks, neonatal intensive care unit stay &gt; 5 days, total hospital stay &gt; 25 days in 6 months, intrauterine growth restriction or small for gestational age, small size for age or height, elevated lead levels, chronic feeding difficulties, suspected central nervous system abnormality, insecure attachment, multiple trauma or loss, maternal age &lt; 17 at child's birth or ≥ 3 + births before age 20, maternal education ≤ 10 years, parent chronic illness or disability that affects caregiving, parent low social support, lacking basic resources, homelessness, open or confirmed child protective services report, substance abuse or dependence in the home, and violence in the home</li> </ul> <p>•Clinical judgment of multidisciplinary team</p> | <p>At least one of the following parent factors: age ≤ 20 with 2 + children or age ≤ 22 with 3 + children, violence in the home, substance abuse in the home, pregnant with previous poor birth outcome, pregnant and beginning prenatal care in 3<sup>rd</sup> trimester, postpartum and had inadequate or no prenatal care, hepatitis B positive</p> <p>Or at least two of the following: housing instability, inadequate food or clothing, tobacco use, history of depression, stress, current high-risk pregnancy, less than a 10<sup>th</sup> grade education, cognitive impairment</p> |

## EIPP as a Child Find Resource for EI

EIPP is one program in Massachusetts that may help mitigate inequities in access to EI services. EIPP serves expectant parents and families with infants who experience challenges to their health and well-being due to socioeconomic barriers, structural racism, inadequate healthcare, emotional and behavioral health challenges, and other stressors. EIPP operates in four communities with higher poverty rates, more adverse perinatal outcomes, and more families involved in the child welfare system, relative to the state as a whole (Goldberg et al., 2020). Participants are referred to EIPP from local hospitals, community health centers, and social service agencies, among other organizations. Participants enroll in EIPP during pregnancy or within 3 months of giving birth and can remain enrolled until the infant's first birthday or enrollment into EI. EIPP eligibility criteria include many of the same social and environmental factors that comprise EI eligibility (see Table 1). Each EIPP program is staffed by a multidisciplinary maternal and child health team of home visitors that includes a community health worker, a licensed mental health clinician or social worker, and a maternal and child health nurse. EIPP teams provide

home visits and group services to (1) conduct screenings and health assessments; (2) provide education, brief interventions, and support on healthy behaviors, parenting, safety, and child development; and (3) facilitate referrals and connections to services, including EI.

EIPP staff begin developmental screenings and health assessments when children are 2 months of age and screens are administered at bimonthly intervals throughout children's first year. EIPP programs are co-located or have strong relationships with their local EI program. Through screenings, assessments, referrals, and relationships with EI service providers and families, the EIPP home visiting program aims to serve as a Child Find for EI, joining up EIPP home visiting with EI services during the perinatal period. Notably, with an intentional equity lens, EIPP screens for and identifies social and environmental challenges that meet EI eligibility criteria among a population of families who may not be aware they are eligible for, or may not typically enroll in, EI services. In this way, EIPP may facilitate families' access to the EI system at an early child age to prevent or attenuate developmental delays. The social determinants of early learning framework (Iruka, 2020) posit that to understand inequities in young children's development and learning,

one must examine the socioeconomic and political contexts (e.g., the labor market, housing policy, education access, and public health) that directly affect families' material circumstances, behavior, and psychosocial factors. By directing services to families who experience circumstances, behaviors, and psychosocial factors that impact young children's health and development, EIPP has the potential to level the playing field for young children and families.

## Study Aims

The present study examined whether the EIPP home visiting program is an effective Child Find resource to support enrolling families into the statewide EI system. The study examined the following questions: (1) Are children who receive EIPP more likely to be referred to, evaluated for, and enrolled in EI relative to children from families with similar background experiences who do not receive EIPP? (2) Do EIPP families get into the EI system earlier than similar families? (3) Are families who receive EIPP more likely to get referred to EI by EIPP than some other referral source? (4) Are families who receive EIPP more likely to meet EI eligibility criteria related to biological, social, and environmental factors relative to families with similar background experiences who do not receive EIPP, and, if so, which factors? and (5) Among families who enroll in EI, what kinds of EI services do they receive?

Given EIPP's role in conducting regular developmental and health screenings and assessments for children and families, we expected that children of EIPP families would be more likely to be referred, evaluated, and enrolled in EI, and do so at an earlier age, than children from families with similar background experiences who did not receive EIPP. Related to EIPP's role as a robust Child Find resource, we hypothesized that most EIPP families would be referred to EI directly via EIPP and that, relative to similar families, a larger proportion of children of EIPP families would meet EI eligibility criteria related to social and environmental factors that increase risk of delay. Finally, while we did not have strong hypotheses regarding specific service receipt, we were interested in whether EIPP families were more likely to receive EI supports from mental health specialists and social workers than similar families.

## Method

### Design

We conducted a quasi-experimental impact study of EIPP families (mother and child dyads) who enrolled in one of the four operational EIPP programs between 2013 and 2017. We

chose this period because the study began in 2018, and many of the data sources have at least a 1-year delay before they are available for analysis and we wanted to be able to track EI usage through age 3, when possible. Children included in the study sample were born between 12/1/12 and 7/1/17. The evaluation used the following secondary data sources: (1) EIPP program data, including families' enrollment and discharge forms, screenings and assessments, and referrals collected by EIPP staff for families enrolled 2013 to 2017; (2) the Massachusetts Pregnancy to Early Life Longitudinal (PELL) data system, including birth certificates and hospital utilization records for mothers and their children from 2012 through 2017; and (3) EI program data for children referred to or enrolled in EI from 2013 through 2019.

### Quasi-experimental Impact Study

To attribute differences in EI participation to EIPP, we derived a matched comparison group of mothers and their children based on birth records of more than 50,000 infants born to mothers living in the EIPP program communities who did not enroll in EIPP during the study period. We used background and maternal health characteristics (referred to as "covariates") from birth records that are related to or likely to influence EIPP eligibility as the basis for matching (see Table 2 for details on the selected matching covariates). Using a large pool of potential comparison group participants is desirable to avoid discarding EIPP participants due to lack of adequate matches on the covariates (Rosenbaum & Rubin, 1985). EIPP participants were removed from the birth records prior to matching; we have no data on families referred to EIPP who did not enroll in the program, so they were not omitted from the potential comparison group. The following children and families were excluded from matching: (1) siblings of the identified EIPP child (to avoid confounding with prior exposure to EIPP), (2) participants who were missing three or more of the matching covariates, and (3) children born after July 1, 2017.

We used coarsened exact matching (CEM) as the primary matching method (Blackwell et al., 2009). CEM groups participants with the same values (raw or coarsened) on each of the covariates into strata that include at least one EIPP and one comparison group participant. CEM yields analytic weights to balance the distribution of program and comparison groups within each stratum for use in subsequent analyses. Across all strata, all matched EIPP participants have a weight of 1. For the comparison group, weights vary by stratum to account for differences in the distribution of the EIPP and comparison groups in each stratum. For example, if 20% of the EIPP sample is in stratum 1, defined by their values on the covariates, the proportion of comparison group participants in stratum 1 also needs to be 20%. The CEM weights provide this adjustment, so the distribution of EIPP

**Table 2** Maternal Background Characteristics of Massachusetts Early Intervention Parenting Partnerships Program (EIPP) Participants from 2013 to 2017 and a Matched Comparison Group

| Characteristic                               | Study Sample<br>( <i>n</i> = 19,406) |
|--|--------------------------------------|
| Program community                            | 14.1%                                |
| Community 1                                  | 19.9%                                |
| Community 2                                  | 47.3%                                |
| Community 3                                  | 18.7%                                |
| Community 4                                  |                                      |
| Maternal age at delivery (years)             | 2.5%                                 |
| 19 and under                                 | 26.0%                                |
| Age 20–24                                    | 71.5%                                |
| Age 25 or more                               |                                      |
| Maternal race/ethnicity                      | 40.3%                                |
| Hispanic                                     | 31.1%                                |
| White non-Hispanic                           | 13.0%                                |
| Black non-Hispanic                           | 15.8%                                |
| Other races, non-Hispanic                    |                                      |
| Mother born in USA                           | 62.8%                                |
| Mother completed high school or equivalent   | 73.8%                                |
| Mother married                               | 36.0%                                |
| Parity (two or more births)                  | 69.9%                                |
| Received adequate prenatal care <sup>a</sup> | 73.7%                                |
| Birth by cesarean delivery                   | 20.6%                                |
| WIC recipient <sup>b</sup>                   | 85.0%                                |
| Medicaid recipient                           | 92.3%                                |
| Father named on birth certificate            | 78.9%                                |

Note. Table reports weighted proportions

<sup>a</sup>Adequate or adequate plus vs. intermediate or inadequate using the Prenatal Care Utilization Index (Kotelchuck, 1994)

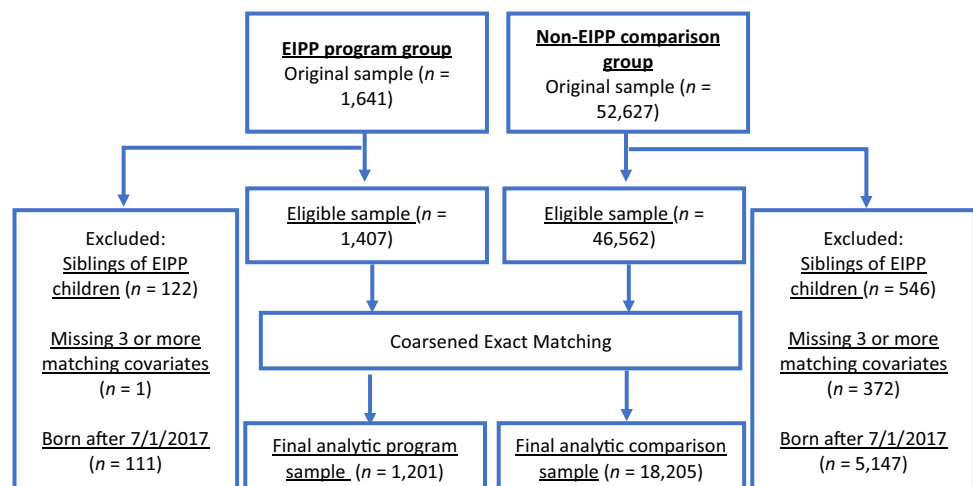
<sup>b</sup>Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

and comparison group participants based on their covariates within each stratum is identical after weighting. Given equal distribution of covariates across the two groups, any differences on outcomes can be attributed to EIPP.

Using CEM, 85.4% of the EIPP sample was matched. Based on L1 statistics, which were nearly 0, we achieved near perfect covariate balance between the EIPP and comparison groups (Iacus et al., 2008). The 15% of EIPP participants that were dropped from the analytic sample tended to be more highly educated and likely to be married. Black participants were slightly more likely to be unmatched in both the EIPP and comparison groups. The rate of missingness for the covariates used in the matching analyses was relatively small (most variables had no missing; missingness for insurance type and WIC receipt were 9% and 16%, respectively); associations between missing data and variables that may explain the prevalence of missing data were negligible. CEM uses missing data in matching.

We ran a series of sensitivity analyses to verify the adequacy of the matching, including using other matching methods such as propensity scores and entropy balance. We also re-specified our CEM matching algorithm with maternal depression and substance use. We were limited to variables included in birth records for the initial matching specification, but received additional data linkages (e.g., PELL) with more data points after matching. All findings remained the same after the sensitivity analyses, but given that we lost sample size when we matched with different algorithms or included additional variables using CEM, we used the samples generated from our original CEM for the present study. We included maternal depression and substance use, and preterm birth as control variables.

**Fig. 1** Massachusetts Early Intervention Parenting Partnerships (EIPP) Program Quasi-Experimental Impact Study Sample Diagram: Original Sample, Excluded Sample, Eligible Sample, and Final Analytic Sample for EIPP Participants from 2013 to 2017 and a Matched Comparison Group



## Sample

Figure 1 illustrates the sampling framework. The final analytic sample included 1,201 EIPP and 18,205 comparison group participants that were identically distributed on the covariates. The sample sizes suggest that EIPP is reaching a small proportion of the eligible population in the EIPP communities.

## Measures

### EI Referrals, Evaluations, and IFSPs

We derived three primary EI outcomes from EI program data: whether children received (1) EI referrals, (2) evaluations for EI eligibility, and (3) individualized family service plans (IFSPs, EI service plans developed by a multidisciplinary team and families). The measurement period for each outcome started when children were 3 months of age, which is the upper age limit for EIPP enrollment (to examine EI participation post-EIPP enrollment) and ended when children were 3 years of age, when EI services end. We coded each binary outcome 1 if children received that service, and 0 if not.

**Focus on Referrals** Among children who were referred to EI ( $n=6,393$ ) between 3 months and 3 years, we examined average child age (in months) at first referral, as well as whether they were referred by the following: EIPP (EIPP participants only); self-referral; other EI program; child protective services; childcare center; WIC; pediatrician, physician, or primary care provider; community health center or clinic; and hospital staff, each coded 1 if the child ever received a referral from that source, and 0 if not.

**Focus on Evaluations** Among children who were evaluated for EI eligibility ( $n=5,216$ ) between 3 months and 3 years, we examined average child age at the time of first evaluation, as well as whether they were ever determined to be eligible for EI services ( $=1$ ) and whether they met eligibility criteria for risk of developmental delay due to biological, social, or environmental factors (alone or in combination with established conditions or delays;  $=1$ ) or were ineligible, or eligible due to disability or developmental delay only ( $=0$ ). Detailed results from children's first evaluation were available for 4,529 children, including the presence or absence of each risk factor for developmental delay including low birthweight, gestational age  $<32$  weeks, neonatal intensive care unit stay  $>5$  days, total hospital stay  $>25$  days in 6 months, intrauterine growth restriction, small size for age or height, elevated lead levels, chronic feeding difficulties, suspected central nervous system abnormality, insecure attachment, multiple trauma or loss, young maternal age,

low maternal education attainment, parent chronic illness or disability that affects caregiving, parent low social support, lacking basic resources, homelessness, open or confirmed child protective services report, substance abuse or dependence in the home, and violence in the home, each coded 1 if the child met the criteria and 0 if not. The variables for basic resources and homelessness had substantial missing data, so were omitted from the analysis.

**Focus on IFSPs** Among children who received signed IFSPs ( $n=4,242$ ) between 3 months and 3 years, we examined child age at the time of the first signing. Using detailed data from children's first IFSP (available for 3,716 children), we examined whether children received any services from the EI specialists, including the speech and language pathologist, social worker, physical therapist, occupational therapist, nurse, mental health specialist, or developmental specialist, each coded 1 if children had any service hours from each specialist and 0 if not. Data on total EI service hours are not presented, as 11% of children were still receiving EI services in 2019, the end point of the EI data.

### Program Status

We created a program status indicator variable to examine differences between the EIPP ( $=1$ ) and comparison group ( $=0$ ) participants, the main independent variable of interest.

### Control Variables

The final EIPP and comparison groups were derived using exact matching; thus, the samples were matched on the selected covariates. To enhance the precision of impact estimates, analytic models incorporated control variables that were not included in the matching: child preterm birth ( $=1$  if born before 37 weeks gestation,  $=0$  if born at 37 weeks or after;  $n=11$  participants were missing data on preterm birth) and maternal depression and substance use. Proxies of maternal depression and substance use were calculated using PELL hospital records to identify any hospitalizations that included an International Classification of Diseases, 9<sup>th</sup> (ICD-9) or 10<sup>th</sup> (ICD-10) edition code for emergency or urgent care related to maternal depression and substance use, respectively, for the year up to the child's birth (any  $=1$ , none  $=0$ ). We also created proxies of intimate partner violence using ICD codes related to hospital visits for intimate partner violence, but the prevalence was nearly 0 so we did not pursue this further. For the main impact analyses examining children's EI referrals, evaluations, and IFSPs from 3 months to 3 years of age, analytic models controlled for previous EI referrals, evaluations, or IFSPs, respectively, from birth to 3 months.

## Analytic Strategy

EIPP impacts on EI referrals, evaluations, and IFSPs were assessed via weighted multivariable regression models. The primary independent variable of interest was the program status indicator, which was entered into the models with the control variables. We fit logistic regression models to binary outcomes (e.g., whether children had an EI referral or not) and ordinary least squares regression models for continuous outcome (e.g., child age at first EI referral). Regression models incorporated the CEM weights and robust standard errors to account for clustering in the data (e.g., siblings in the comparison group; all EIPP siblings were removed from both the EIPP and comparison groups as part of the exclusion criteria). Models estimated the average treatment effect on the treated. We computed probabilities (for binary outcomes) and means (for continuous outcomes) adjusted for the control variables for the EIPP and comparison groups for each outcome. Following the main impact analyses on EI referrals, evaluations, and IFSPs, the remaining analyses subset the sample to participants who had an EI referral (i.e., age at first referral, referral source), evaluation (i.e., age at first evaluation, evaluation results, eligibility), or IFSP (i.e., age at first IFSP signing, receipt of services from EI specialists) post-3 months. The CEM weights were re-estimated for the subsample of participants with EI referrals. Findings did not change with the inclusion of the new weights; thus, the same matched sample and CEM weights were used for all analyses. All analyses were conducted using Stata 17. MDPH's Institutional Review Board and Data Access reviewed and approved the study.

**Table 3** Logistic regressions results for Massachusetts Early Intervention Parenting Partnership (EIPP) Program Impacts on Early Intervention (EI) Referrals, Evaluations, and Individualized Family

|                            | EI referrals |           | EI evaluations |           | EI IFSPs |           |
|----------------------------|--------------|-----------|----------------|-----------|----------|-----------|
|                            | OR           | 95% CI    | OR             | 95% CI    | OR       | 95% CI    |
| EIPP                       | 3.25***      | 2.75–3.84 | 1.49***        | 1.30–1.72 | 1.60***  | 1.38–1.84 |
| Maternal depression        | 1.35         | 0.91–1.99 | 1.73**         | 1.16–2.59 | 1.53*    | 1.01–2.32 |
| Maternal substance use     | 1.53**       | 1.20–1.95 | 1.54**         | 1.20–1.97 | 1.70***  | 1.31–2.21 |
| Preterm birth <sup>a</sup> | 1.40**       | 1.10–1.79 | 1.55**         | 1.21–2.00 | 2.04***  | 1.61–2.59 |
| Previous EI <sup>b</sup>   | 0.58***      | 0.54–0.63 | 0.41***        | 0.30–0.55 | 0.39***  | 0.28–0.33 |

Note.  $n = 19,395$  ( $n = 11$  missing preterm birth)

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

<sup>a</sup>Born before 37 weeks of gestation

<sup>b</sup>To assess EI referrals, evaluations, and IFSPs post-EIPP enrollment, the outcomes were measured starting when children were 3 months of age, the upper limit of EIPP enrollment. Analytic models controlled for any EI referrals, evaluations, and IFSPs, respectively for each of the three models that occurred between birth and 3 months

## Results

### Characteristics of the Matched Sample

Table 2 displays the sample characteristics for EIPP and comparison group families based on the matching covariates. As CEM matches the samples exactly and there are no differences between the groups on any of the covariates, we present characteristics for the full analytic sample ( $n = 19,406$ ). The sample largely comprised people of color and people on Medicaid.

### EIPP Impacts on EI Referrals, Evaluations, and IFSPs

Relative to the matched comparison group, children of EIPP families had greater odds of EI referrals, evaluations, and IFSPs (see Table 3). Nearly two-thirds (65.5%) of children of EIPP families was referred to EI between the ages of 3 months and 3 years, relative to 37.1% of the comparison group. Forty percent (39.5%) of children of EIPP families were evaluated and 34.6% received IFSPs, relative to 30.6% and 25.1% of the comparison group for evaluations and IFSPs, respectively.

### Focus on Referrals

Among children who were referred to EI at age 3 months or later, the average age of first referral was nearly 10 months earlier for children of EIPP families relative to the comparison group (5.66 months EIPP, 15.02 months comparison,  $p < 0.001$ ). Looking across referrals, most children of EIPP families (71.5% of EIPP families who were referred to EI) had at least one EI referral made by EIPP directly. Children

Service Plans (IFSP) between 3 Months and 3 Years of Age among EIPP Participants from 2013 to 2017 and a Matched Comparison Group

in the comparison group were more likely than children of EIPP families to receive at least one referral from child protective services (regression adjusted probabilities: 14.7% EIPP, 28.7% comparison,  $p < 0.001$ ), childcare centers (3.4% EIPP, 5.4% comparison,  $p < 0.05$ ), medical facilities (pediatrician, physician, or primary care provider, 14.3% EIPP, 33.4% comparison,  $p < 0.001$ ), community health center or clinic (7.9% EIPP, 11.9% comparison,  $p < 0.05$ ), hospital staff (2.4% EIPP, 4.6% comparison,  $p < 0.05$ ), and self-referrals (13.1% EIPP, 19.3% comparison,  $p < 0.001$ ). There was no difference between the two groups in the likelihood of referrals from WIC (0.9% EIPP, 2.1% comparison) and other EI programs (1.8% EIPP, 2.4% comparison).

### Focus on Evaluations

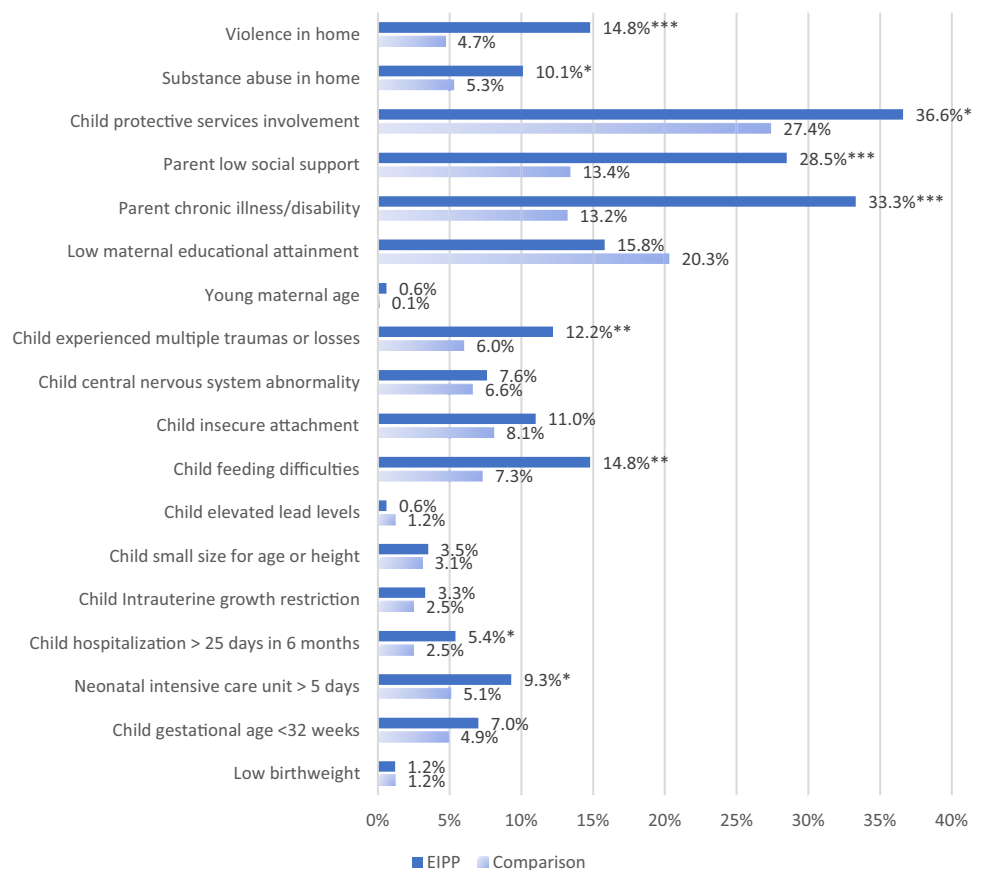
Among children who were evaluated for EI, children of EIPP families were evaluated about 3 months earlier, on average, than children in the comparison group (12.82 months EIPP, 15.96 months comparison,  $p < 0.001$ ). Children in the EIPP and comparison groups had the same odds of EI eligibility. About 87% of the evaluated sample was eligible (88.6%

EIPP, 86.0% comparison), but EIPP families were more likely than comparison group participants to meet the eligibility criteria for risk of developmental delay due to biological, social, or environmental factors, alone or in combination with established conditions or delays (23.8% EIPP, 14.1% comparison,  $p < 0.001$ ); remaining eligible children met criteria for established conditions or delays. Looking across the biological, social, and environmental risk factors for developmental delays, several differences emerged between the EIPP and comparison groups (see Fig. 2). Children of EIPP families were more likely than the comparison group to meet eligibility criteria for violence or substance abuse in the home, child protective services involvement, parent low social support, parent chronic illness or disability affecting caregiving, multiple traumas, feeding difficulties, hospitalization more than 25 days, and NICU stay more than 5 days.

### Focus on IFSPs

Among children who received EI services, IFSPs were signed more than 3 months earlier for children of EIPP

**Fig. 2** Identified Biological, Social, and Environmental Risk Factors Based on Early Intervention (EI) Evaluations Among Massachusetts Early Intervention Parenting Partnerships (EIPP) Program Participants from 2013 to 2017 and a Matched Comparison Group



*Note.*  $n = 4,529$ . Percentages adjusted for maternal depression, maternal substance use, and child preterm birth (born before 37 weeks of gestation) and reflect whether participants met eligibility criteria for each risk factor based on early intervention evaluation. \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$



families relative to the comparison group (13.46 months EIPP, 17.14 months comparison,  $p < 0.001$ ). Once enrolled in EI, children of EIPP families were more likely than the comparison group to receive services from a mental health specialist (12.8% EIPP, 7.1% comparison,  $p < 0.01$ ); the two groups had equal odds of receiving support from other EI specialists including speech and language (5.1% EIPP, 6.3% comparison), social worker (15.6% EIPP, 15.5% comparison), physical therapist (5.8% EIPP, 5.0% comparison), occupational therapist (8.6% EIPP, 8.4% comparison), nurse (6.3% EIPP, 4.9% comparison), and developmental specialist (69.6% EIPP, 71.1% comparison).

## Discussion

The present study examined whether EIPP, a home visiting program for pregnant and postpartum people in four Massachusetts communities, met its aim of identifying, referring, and connecting children who experience social and environmental stressors to EI services. Findings revealed that, relative to a matched comparison group, EIPP families were more likely to be referred to, evaluated for, and receive EI services. They also were connected to EI earlier—10 months for referrals and 3 months for evaluation and IFSPs, on average. These data demonstrate that EIPP is an effective Child Find resource in Massachusetts. The finding that the program was particularly successful in identifying children who are at risk for developmental delays due to the presence of social and environmental factors (as opposed to children who already have established delays or conditions) highlights the potential role of EIPP as an effective prevention service.

### EIPP's Role in Child Find and Prevention

Findings revealed that EIPP families who were evaluated for EI eligibility were more likely than the comparison group to meet EI eligibility pertaining to risk of developmental delay due to social or environmental factors, notably, violence and substance use in the home, child protective services involvement, multiple traumas, parenting stress, and parent chronic illness or disability. Past research suggests that EI has had mixed success providing evaluations and services to families of color, families who speak languages other than English, and families experiencing poverty and related stressors (Clements et al., 2008). By conducting regular formal screenings and assessments, as well as engaging in informal “assessments” via conversations with and observations of families, EIPP home visitors are well positioned to make referrals for families who may not otherwise have been aware they were eligible for EI services or faced other barriers to receipt. Furthermore, EIPP staff had strong relationships with EI in their local communities and, in some

cases, were co-located or shared staff, which enabled them to make “warm hand-offs” to the EI program, and even inform the content of families’ IFSPs. These activities—the everyday work of EIPP home visitors—promoted early access to the EI system for families whom research suggests are inconsistently served by EI.

It is important to note, however, that while EIPP was highly successful at referring families to EI relative to the comparison group, the impacts on evaluations and IFSPs were smaller. Indeed, while EIPP participants received their first referral at an average of 5 or 6 months, they did not receive their first evaluation until about 7 months later. Post-evaluation, they connected to services relatively quickly: less than a month later, on average. These findings suggest that further work could be done by EIPP to ensure referrals yield subsequent evaluations, to ensure successful linkages to EI services.

Among children with IFSPs, we saw few differences in the types of EI support children of EIPP families received relative to the comparison group. One notable exception was that children of EIPP families were more likely than children in the comparison group to receive support from EI mental health specialists. Given their EI eligibility due to violence and substance use in the home and parenting stress, this finding is reassuring because it recognizes the importance of attending to the mental health needs of children and their families in the context of traumatic exposure. However, we are unable to assess if children’s exposure to trauma and risk is reduced due to this specialist support. Furthermore, we were surprised that there were no differences between the EIPP and comparison groups in the likelihood of receiving support from a social worker. This may be due to the availability of staffing within EI programs or the need for social work support among the comparison group, who also experienced a range of social and environmental risk factors.

Home visiting programs, like EIPP, that address families’ resource and parenting needs and refer children to EI and other early childhood supports may play an important role in mitigating the pernicious impacts of poverty and related experiences on children’s development now and into the next generation (Minkovitz et al., 2016). There are strong calls for a coordinated response across early childhood systems to support young children and their families who are affected by poverty, racism, and other stressors to protect them from any physiological, neurological, and behavioral manifestations of early adversity (Shonkoff et al., 2012). Programs like EIPP are a critical component of this response.

### Limitations

Our study benefited from a large sample across four Massachusetts communities and access to administrative EI data. Despite these strengths, several factors limit the robustness

of the study. First, we used statistical matching methods to derive the comparison group and were limited to data available in birth records to match EIPP participants and the potential comparison group. While birth records include a rich array of data on demographic and health-related characteristics, and matching participants with the comparison group on these covariates likely attenuated bias, they do not include data on some of the social and environmental factors related to EI eligibility, such as parents' mental health and substance use or prior involvement with child protective services. Given EIPP eligibility criteria and findings from this study, it is likely that the EIPP participants were more likely to experience these psychosocial challenges prior to giving birth than other people in their communities, from which we selected the comparison group. We aimed to minimize bias by including indicators of depression and substance use as control variables in analytic models. In sensitivity analyses, we rematched the sample including these two variables, and the findings were unchanged from what is reported in this paper. A related confound is lack of data on whether any families included in the comparison group were offered EIPP services but declined. Families that declined EIPP services may also be more likely to decline EI services. Our inability to fully measure and control for these potential confounds is a limitation.

Second, the EI data were available only through September 2019 at the time of our analyses, which meant that approximately 20% of the sample was not yet 3 years of age and thus still eligible for EI services. This data censoring prevented us from examining the total number of EI services received and duration of EI enrollments across the sample. Future studies with additional EI data or using survival methods can examine whether EIPP leads to a particular pattern of service use or longer total duration relative to the comparison group.

The timing of our study predates the COVID-19 pandemic. Families' needs have increased, existing racial and health inequities exacerbated, and programs like EIPP have had to step in—for example by providing emergency food and rental assistance—to support families who have not been served equitably by institutions and policies. It is possible that EIPP has had to pivot and adapt their approach and services in the past 2 years and may look slightly different now than it did pre-pandemic.

Finally, the purpose of EI is to provide support for children's development, focusing on children experiencing or at risk of developmental delay. And while the findings from the present study provide a detailed look at the impacts of a home visiting program on young children's referrals and take-up of EI services, we were unable to examine impacts of EI on children's development. Thus, while the reported findings are favorable for EIPP as an effective Child Find resource, the wider benefits on children's development and

well-being are not known. Longer-term data on children's outcomes across a range of domains would be useful to understand how children fare over time.

## Conclusion

A key component of part C of the IDEA is identifying children who are eligible for EI as early as possible. As a program that enrolls families prenatally or within 3 months postpartum, EIPP is one of the first programs families with infants encounter and is uniquely positioned to serve as an important Child Find resource in its respective communities. This study confirmed EIPP's effectiveness in this role; not only did EIPP programs connect children earlier, but they facilitated the identification of children with social and environmental risk factors for developmental delay (as opposed to just those with confirmed delays), maximizing the potential for prevention of later challenges. EIPP serves as a critical entry point into an early childhood system of care, playing a crucial role in helping families attain comprehensive supports to optimize their well-being and enhance children's development.

**Funding** This study was funded by the Massachusetts Department of Public Health (Contract ID: INTF3218HH2500224099).

## Declarations

**Ethics Approval** This study was approved by the Massachusetts Department of Public Health Institutional Review Board and Data Access (1340024) and was performed in accordance with the ethical standards from the 1964 Declaration of Helsinki and its later amendments and the Common Rule.

**Informed Consent** The study used secondary data sources; the IRB determined that the study met the requirements to waive informed consent.

**Conflict of Interest** The authors declare no competing interests.

**Disclaimer** The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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