



College of Medicine

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Supporting Families: Evaluation of the Healthy Families America Home Visiting Program in Arkansas

June 2021



Suggested Citation

McKelvey, L.M., Lewis, K.N., & Li, J. (2021). *Supporting Families: Evaluation of the Healthy Families America Home Visiting Program in Arkansas*. University of Arkansas for Medical Sciences. Little Rock, AR.

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Evaluation of Healthy Families America

Executive Summary

Background

Healthy Families America (HFA) is an evidence-based home visiting program that provides parenting education and supports with the overall goal of preventing child maltreatment. As such, HFA was designed to work with families with children who are theoretically and empirically demonstrated to be at increased risk for maltreatment (e.g., families with mental health issues, substance abuse issues, intimate partner violence). HFA is rooted in the understanding that optimal relational health between caregivers and their child(ren) is the foundation for life-long, healthy development. HFA services are voluntary, intensive, and longitudinal with most families initiating services during pregnancy and continuing for 3-5 years after the birth of the baby. The HFA model is a well-supported, evidence-based home visiting program.¹⁻³

Healthy Families America has been implemented in Arkansas since 1996. The program started in Arkansas primarily for adolescent parents. Research demonstrated the Arkansas program was effective at decreasing risk for corporal punishment and other parenting beliefs associated with child maltreatment.⁴ In 2012, Arkansas was awarded funds from the Health Resources and Services Administration's Maternal, Infant, and Early Childhood Home Visiting program to expand HFA services.

Pregnant women and families who are at risk for parenting beliefs and/or practices that are associated with less optimal child outcomes (e.g., low-income, substance use) are eligible for services. HFA suggests that a majority (80%) of families enroll during pregnancy or child under the age of 3 months and that services continue through the child's third birthday, although HFA services can extend through the child's fifth birthday. HFA is typically delivered by individuals with bachelor's degrees in social work, psychology, or a related field. Each home visitor can serve a range of 15 to 24 families. Caseloads vary according to the frequency of home visits each family will receive. Frequency is based on a family needs assessment and the trimester of pregnancy.⁵

Evaluation Goals

The goals of this evaluation are to assess whether HFA impacts birth outcomes, the health and health care use of children, and the health care use of mothers. This evaluation addresses the following research questions, based on the age of the child at enrollment:

1. For families enrolled in HFA in pregnancy, will children have better pregnancy and birth outcomes than a propensity matched sample of children who did not receive the HFA program? Pregnancy and birth outcomes include preterm birth, low birth weight, and maternal breastfeeding intention.
2. For all families enrolled in HFA, will children have better health and health care outcomes than a propensity matched sample of participants who did not receive the HFA program? Child health care use and health outcomes include hospitalizations, emergency department use, outpatient visits, immunizations, and infant mortality.
3. For all families enrolled in HFA, will mothers have better health outcomes than a propensity matched sample of participants who did not receive the HFA program?

Maternal outcomes will include hospitalizations, emergency department use, and outpatient visits.

Evaluation Design

This study is a quasi-experimental, intention-to-treat evaluation, which used administrative data to compare outcomes of infants receiving the HFA intervention to a propensity-score matched (PSM) control population of infants not receiving HFA with similar demographic, socio-economic, and medical characteristics. For pregnancy and birth outcomes, the sample was restricted to those who enrolled in pregnancy with the opportunity of at least 3 months of services (calculated as enrolled at least 3 months before the child's expected date of birth as recorded on the birth certificate). In a well-balanced match, where HFA and non-HFA are systematically similar across all characteristics, differences between HFA and non-HFA outcomes determine the effectiveness of the treatment. An intention-to-treat approach was taken as HFA infants may have been enrolled in the intervention, but parents/guardians may have subsequently declined to receive services at any time after enrollment. This approach will produce conservative analytic results.⁶

Vital statistics, health care coverage program enrollment, medical, and pharmacy claims records are continuously updated. There is a refresh of data for the University of Arkansas for Medical Sciences Arkansas Biosciences Institute (ABI) subscription once a year. For this study, we used administrative claims and vital statistics (birth and death certificate) records from January 1, 2014 to December 31, 2019. Mothers and children with dates of birth between January 1, 2014 and December 31, 2019 who were served by HFA were eligible for inclusion (N=1,012 mother and child dyads).

Results

Results suggest that HFA positively affects the birth outcomes of infants when services are provided prenatally. When examining the birth outcomes of children whose mothers enrolled at least 3 months before the child's birth, we find that **newborns in HFA had significantly lower odds of being born preterm** and **marginally lower odds of being born low birth weight** than newborns in the control group. **Mothers in HFA also had significantly higher odds to report intention to breastfeed** than those in the control group.

When we examine health care use, we find **infants in HFA are significantly more likely to use health care systems** than infants in the control group. Infants in HFA had a higher overall number of hospitalizations between their birth and first birthday, but this difference was not observed as children age. Infants in HFA had a higher overall number of visits to the emergency department (ED) in their first and second years of life than children in the control group (overall and for evaluation and management). Other studies of ED use in HFA report no effect, or a similar effect as reported here, that children in the program used the ED at greater rates than the control group.⁷ Like our findings, results from an Infant Mental Health home visiting program for low-income families also reported increased ED use overall and for more minor reasons.⁸ It is unclear that use of the ED for less urgent care should be considered a negative impact.

Infants in HFA also had a greater number of total outpatient medical appointments from birth through age 3. Infants in HFA had greater use of wellness (Years 1 and 3) and non-wellness visits (Year 1) than non-HFA control infants. The number of well-child visits has been an outcome of interest in evaluations of HFA. Overall, studies report little impact from birth to 3,⁹⁻¹² with one study reporting impacts on well-child visits only in the child's third year of life.¹¹

An additional outpatient service we investigated was early intervention for Speech-Language Pathology services. **HFA infants also had more SLP services than those in the control group in their first year of life.** HFA screens children's development starting at age 2 months using the Ages and Stages Questionnaire¹³ and the Ages and Stages Questionnaire: Social-Emotional.¹⁴ Developmental screening is completed on a recurring basis every 6 months based on the child's age. It would appear that this developmental surveillance provided by HFA increased the use of early intervention services for speech and language therapies. **The current study is the first to demonstrate positive impacts on receipt of early intervention services.**⁷ Early identification and services for developmental delay puts children in HFA on a positive developmental trajectory.¹⁵

Infants in HFA were significantly more likely to have more visits in the first year of life in which immunizations were provided and to have significantly higher odds of having had at least four immunization visits in the first year (our proxy for having completed the immunization series) than infants in the control group. These differences in immunization were observed as children aged, with children in HFA having significantly more visits with immunizations between the ages of 1 and 2 and the ages of 2 and 3. Though data from other home visiting interventions have demonstrated favorable impacts¹⁶, **this is the first HFA evaluation to demonstrate a positive impact on immunizations.**⁹⁻¹¹ Childhood immunizations prevent disease, thereby reducing childhood mortality and morbidity.

From birth to their child's first birthday, **mothers who were served by HFA had greater use of the ED overall** and for non-urgent visits than mothers in the matched-control group. HFA mothers also had a greater number of overall outpatient visits, and specifically non-wellness visits. Mothers also had a greater number of visits in which discussion of mood and substance-related disorders were discussed than the matched control group. Differences between the groups as children aged became fewer, but there remained a significant positive association between HFA and overall outpatient visits and visits that covered the topic of mood disorders in Year 2 and Year 3. Because HFA acknowledges that parent-child relational health is paramount to healthy child development,¹⁷⁻¹⁹ the intervention attends to the emotional needs of parents. HFA in Arkansas screens mothers for depression and substance use on a recurring basis (e.g., within a month of enrollment, 8 weeks of delivery, and every 6 months based on their child's age) with the intention of supporting the mother with referrals for additional services. Our measurement of this dimension differs from what is typically reported in the literature (i.e., the score on behavioral health instruments). With the exception of one investigation,²⁰ the majority of studies of behavioral health in mothers served by HFA have reported null findings.^{10-12,21,22} **Our findings suggest that the screening and referral is supporting mothers in HFA to discuss their mental health needs within the health care system.**

Our findings contribute novel information, being among the first to document the association between HFA home visiting and insurance claims related to birth, child health, and child and maternal health care use. Our results indicate the increased likelihood of positive developmental outcomes for children whose families are served by HFA. For those enrolling in pregnancy, we demonstrate more positive birth outcomes and likelihood of breastfeeding, which supports healthy development. It would also appear that the education provided by HFA increases parental support seeking for prevention, which increases the likelihood of immunization completion. We also find that parents in HFA seek medical care even for more minor reasons. Further, findings also suggest that HFA increases the likelihood of receipt of early intervention services when children are in need of developmental supports. Finally, HFA increases the mother's use of the health care system. Specifically, the supports sought for behavioral health reasons are increasingly recognized as essential for optimal relational health that would ultimately support the child's development.¹⁷⁻¹⁹ Taken together, the data present that HFA as implemented in Arkansas provides children and their families multiple benefits that improve their health and development.

Background

The benefits of home visiting programs to the health and development of at risk families and their infants and young children have been emphasized by several professional organizations, such as the American Academy of Pediatrics and the Academic Pediatric Association.^{23–25} They emphasize that these programs are a mechanism to ensure that at-risk families have social support; linkage to health care and a variety of public and private needed services; and ongoing health, developmental, and safety education.

Healthy Families America (HFA) is an evidence-based home visiting program developed to provide parenting education and supports with the overall goal of preventing child maltreatment. As such, HFA was designed to work with families with children who are theoretically and empirically demonstrated to be at increased risk for maltreatment (e.g., families with mental health issues, substance abuse issues, intimate partner violence). HFA is rooted in the understanding that optimal relational health between caregivers and their child(ren) is the foundation for life-long, healthy development. HFA services are strengths-based, family-centered, culturally sensitive, reflective, and ultimately designed to promote positive parent-child relationships and healthy attachment. HFA services are voluntary, intensive, and longitudinal, with most families initiating services during pregnancy and continuing for 3-5 years after the birth of the baby. The HFA model is a well-supported, evidence-based home visiting program.^{1–3}

Healthy Families America has been implemented in Arkansas since 1996. The program started in Arkansas primarily for adolescent parents. Research demonstrated the Arkansas program was effective at decreasing risk for corporal punishment and other parenting beliefs associated with child maltreatment.⁴ In 2012, Arkansas was awarded funds from the Health Resources and Services Administration's Maternal, Infant, and Early Childhood Home Visiting program to expand HFA services in the state.

Description of Intervention

Pregnant women and families who are at risk for parenting beliefs and/or practices that are associated with less optimal child outcomes (e.g., low-income, substance use) are eligible for services. HFA suggests that a majority (80%) of families enroll during pregnancy or when children are under the age of 3 months and that services continue through the child's third birthday, although HFA services can extend through the child's fifth birthday. HFA is typically delivered by individuals with bachelor's degrees in social work, psychology, or a related field. Each home visitor can serve a range of 15-24 families. Caseloads vary according to the frequency of home visits each family will receive. Frequency is based on a family needs assessment and the trimester of pregnancy.⁵

Referrals to HFA are solicited from partnering social services agencies and medical providers (e.g., educational settings; court and child welfare providers; Women, Infants and Children programs; and obstetrics and gynecology practices). There have been 16 local implementing agencies across the state with services being available in 30 of Arkansas's 75 counties. A central administrative team within the Arkansas Home Visiting Network provides model support and the national administrative team monitors implementation fidelity. HFA does

not prescribe a specific curriculum. Arkansas selected the *Partners for a Healthy Baby* curriculum to support program implementation.^{26,27}

Methods

Evaluation Design and Research Questions

This evaluation addresses the following research questions, based on the age of the child at enrollment:

1. For families enrolled in HFA in pregnancy, will children have better pregnancy and birth outcomes than a propensity matched sample of children who did not receive the HFA program? Pregnancy and birth outcomes will include:
 - a. preterm birth (PT; occurring earlier than 37 weeks gestational age),
 - b. low birth weight (LBW; birth weight < 2500 grams), and
 - c. breastfeeding intention.

2. For all families enrolled in HFA, will children have better health and health care outcomes than a propensity matched sample of participants who did not receive the HFA program? Child health care use and health outcomes will include:
 - a. hospitalizations,
 - b. emergency department visits and non-urgent emergency department visits,
 - c. wellness and non-wellness health care visits,
 - d. speech-language therapy visits,
 - e. clinical visits where immunizations are provided and immunization completion, and
 - f. infant mortality.

3. For all families enrolled in HFA, will mothers have better health outcomes than a propensity matched sample of participants who did not receive the HFA program? Outcomes will include:
 - a. hospitalizations,
 - b. emergency department visits and non-urgent emergency department visits,
 - c. wellness and non-wellness health care visits, and
 - d. clinical visits with behavioral health supports.

This study is a quasi-experimental, intention-to-treat evaluation. The study used administrative data to compare outcomes of infants receiving the HFA intervention to a propensity-score matched (PSM) control population of infants not receiving HFA with similar demographic, socio-economic, and medical characteristics. For pregnancy and birth outcomes, the sample was restricted to those who enrolled in pregnancy with the opportunity of at least 3 months of services (calculated as enrolled at least 3 months before the child's expected date of birth as recorded on the birth certificate). In a well-balanced match, where HFA and non-HFA are systematically very similar across all characteristics, differences between HFA and non-HFA outcomes will determine the effectiveness of the HFA treatment. An intention-to-treat approach

was taken as HFA infants may have been enrolled in the intervention, but parents/guardians may have subsequently declined to receive services at any time after enrollment. This approach will produce conservative analytic results.⁶

Data Sources

Vital statistics, health care coverage program enrollment, medical, and pharmacy claims records are continuously updated. There is a refresh of data for the University of Arkansas for Medical Sciences Arkansas Biosciences Institute (ABI) subscription once a year. For this study, we were able to use administrative claims and vital statistics (birth and death certificate) records from January 1, 2014 to December 31, 2019 using the sources described below.

Arkansas All-Payer Claims Database (APCD): In 2015, the Arkansas General Assembly established the Arkansas Healthcare Transparency Initiative (AHTI) to address the state's data needs to improve health and to support research. This initiative mandates entities throughout the state to submit medical, pharmacy, and dental claims from Arkansans. This led to the creation of the APCD, a large-scale database securely administered by the Arkansas Center for Health Improvement (ACHI) and governed by the Arkansas Insurance Department (AID). The APCD includes claims for all Arkansans starting in 2013, with claims data updated on an annual basis. ACHI and AID keep all records within the APCD confidential and manage and regulate data requests and subscriptions for researchers wishing to use the information.

Vital Statistics Records: The Arkansas Department of Health (ADH) Vital Statistics provides individual and address-level birth event data found on an Arkansas birth certificate about the child, mother (if available) and father (if available) from 1989 to 2019. Arkansas revised birth certificates in 2014, which were used in the current evaluation. ADH Vital Statistics also provide individual- and address-level death event data found on an Arkansas death certificate. Birth and death certificate records data are included in the ABI subscription of APCD.

Data Linkage Description: Within the ABI APCD subscription, ACHI extracted data fields for our analyses. The APCD uses HASH IDs to differentiate individuals and to protect any personally identifiable information within the data. The HASH ID is an anonymous, unique 44-character identifier that incorporates a person's last name and date of birth. The HASH ID is further combined with gender to improve data linkage accuracy. Individuals are linked by HASH ID across different data sources.

Measures

Measures used in the PSM and study outcomes are drawn from the data sources described above. Insurance claims codes used in the definition of measures are provided in Appendix D.

Propensity Matching: Matching characteristics and the data source used in the PSM are as follows.

1) Family Demographic Matching Variables

The following list of variables was used for matching for all outcomes explored (Birth Outcomes, Child and Maternal Health and Health Care Outcomes):

Demographics and Socioeconomic Status:

- child gender (birth certificate)
- mother race/ethnicity; age category at birth; education; Women, Infants, and Children (WIC) benefits receipt; insurance type; marital status at birth; father date of birth record availability; and smoking status during pregnancy (birth certificate)
- family rural-urban commuting area code (RUCA; birth certificate)

2) Health and Health Care Matching Variables

For Child Health and Health Care Use Outcomes, match indicators included the demographic and socioeconomic indicators listed in Family Demographics Matching Variables and the following child health indicators:

- child weight and gestational age at birth and the 5-Minute APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) score
- child length of stay in the hospital after birth (APCD)
- delivery method (birth certificate).

For Maternal Health Care Use Outcomes, match indicators included the demographic and socioeconomic indicators listed in Family Demographics Matching Variables and the following maternal health indicators:

- mother length of stay in the hospital after delivery (APCD)
- delivery method (birth certificate)

Outcomes: Birth outcomes, child health and health care outcomes, early intervention services outcomes, and their sources are as follows:

1) Birth Outcomes (All Outcomes from Birth Certificate Data)

- preterm birth (PT; occurring earlier than 37 weeks gestational age)
- low birth weight (LBW; birth weight < 2500 grams)
- breastfeeding intention

2) Child Health and Health Care Services

- hospitalizations (APCD)
- emergency department visits: total and visits for evaluation and management (APCD)
- outpatient visits: total and specific visit categories as follows: (APCD)
 - wellness
 - non-wellness
 - early intervention services for speech-language pathology (SLP) therapies²⁸
- filled pharmacy prescriptions (APCD)
- immunization outcomes (APCD)

- total number of immunization visits per year
- complete immunization coverage defined as a minimum of 4 immunization encounters in the first year of life. (Guidelines recommend a minimum of 5 encounters—not including influenza vaccination—to complete the immunization series, with the last round of immunizations administered between 12 and 18 months of age.²⁹)
- infant mortality defined as death within the first year of life¹ (Death Certificate)

3) Maternal Health Care and Early Intervention Services (all from APCD):

- hospitalizations
- emergency department visits: total and visits for evaluation and management
- outpatient visits: total and specific visit categories:
 - wellness
 - non-wellness
 - visits for mood disorders
 - visits for substance-related disorders
- filled pharmacy prescriptions

Approach to Analysis

At the first analytic stage, a one-to-one HFA and non-HFA infant matching strategy was implemented using a combination of exact category and greedy nearest neighbor propensity scores matching. The variables included in the PSM are provided in the measures section. Both child groups had to be identical in child gender and maternal race/ethnicity to be matched for birth outcomes. In addition to gender and race, preterm birth status was also required to be identical to be matched for child health and health care utilization outcomes. For maternal health care use outcomes, both mother groups had to be identical in race/ethnicity. Additionally, using SAS (SAS Institute, Cary, NC) proc psmatch,^{31,32} both child and mother groups were matched by propensity score. The probability of each group being assigned to the HFA treatment was equal or nearly equal based on all remaining covariates included in the logistic regression model. The greedy nearest neighbor matching algorithm attempts sequential matches between HFA and non-HFA infants where the within-pair propensity score difference is the smallest. A potential bias due to those outside the exact match blocks and residual confounding is addressed in the next step.

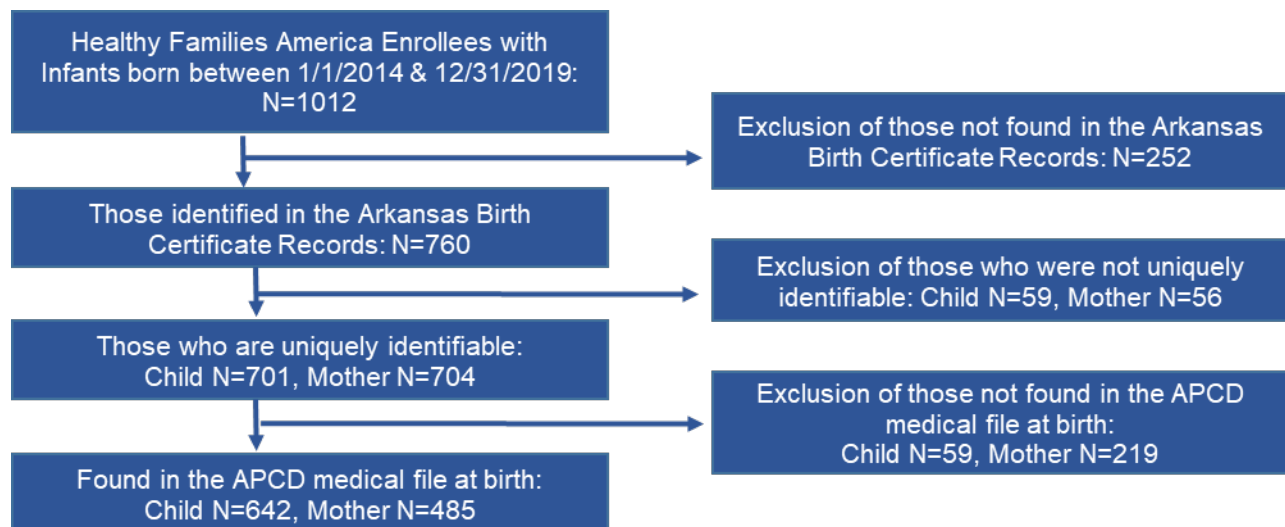
At the second analytic stage, we used a bias correction approach by fitting generalized linear integrated mixed models for each health care utilization outcome. An indicator of each HFA and non-HFA one-to-one matched dyad was included in the mixed models as a random variable. Count distribution outcome models were fitted by specifying a negative binomial distribution (chosen over a Poisson distribution due to significant over-dispersion parameter estimates) with a log-link function. A binomial distribution with a logit-link function was used for the binary outcomes. Differences in HFA and non-HFA utilization were determined using incident rate ratios (IRR, for Poisson count), adjusted odds ratios (aOR, for binary outcomes), and p-values.

Sample Size and Sampling Plan

The primary population targeted in this evaluation is high-risk pregnant women and children from birth to 3 years old. APCD and birth certificate records from 2014 to 2019 were used to exclude families and to identify the study population. Mothers and children with dates of birth between January 1, 2014 and December 31, 2019 who were served by HFA were eligible for inclusion (N=1,012 mother and child dyads). Mothers and children who did not meet each of the following criteria were excluded (see Figure 1):

- not found in the birth certificate file (Child N=252, Mother N=252)
- not uniquely identifiable by HASH ID (Child N=59, Mother N=56)
- not found in the APCD eligibility file (Child N=59, Mother N=219)

Figure 1: Flow Diagram Depicting the Development of the Analyzable Child Population



We examined whether there were service or demographic differences between children who were served by HFA and identified within the data with those who were served by HFA (N=642), but who were not found in the birth certificate records, not uniquely identifiable, and not in the APCD (N=370; See Appendix A). There were not significant differences in whether the family enrolled during pregnancy or the length of enrollment in services. There were also not significant differences demonstrated for the majority of demographic indicators examined, including child gender, maternal educational attainment, educational status, marital status, or employment status at enrollment. There was a demonstrated difference in maternal race/ethnicity where families with mothers identifying as Hispanic were more likely to be excluded from analysis. Unfortunately, this is somewhat expected as Arkansas has one of the highest rates of uninsured Latino children in the nation.³³ There was also a greater loss of mothers from the APCD linkage, which is to be expected as income eligibility for Medicaid is lowered during pregnancy, and coverage ends at 60 days post partum.³⁴

Two analytic samples for the birth outcomes were created. A match was made for all of the 209 expectant mothers who enrolled in HFA at least 3 months before the child's birth; keeping the full sample retained for the analysis of birth weight and child gestational age at birth (see Table B-1). Based on data availability, the candidates for match were further restricted when examining the breastfeeding intention outcome (N=147). All individuals retained in the restricted universe were matched (see Table B-2).

Three analytic samples for the health outcome and utilization analyses were created to correspond to child observation windows: from hospital discharge through age 1 year (Year 1), ages 1-2 years (Year 2), and ages 2-3 years (Year 3). Each of the analytic samples includes all participants who satisfied the inclusion/exclusion criteria as in Figure 1, had claims data for at least one observation window, and for whom an adequate propensity match could be made. We did not limit our sample based on the duration of the program. Out of 604, 485, and 395 child candidates, a match was made for 601, 482, and 391 HFA child participants in Year 1, Year 2, and Year 3 observation windows, respectively. The pre- and post-propensity score matching characteristics for child health care and birth outcomes are provided in Tables B-3, B-4, and B-5.

For the analysis examining infant mortality, we used all participants who satisfied the inclusion and exclusion criteria, as in Figure 1, as a candidate for propensity score match. Out of 701 candidates, a match was made for 697 HFA participants. The pre- and post-propensity score matching characteristics for the infants included in the mortality analysis is in Table B-6.

For maternal health care use outcomes, three analytic samples were created to correspond to hospital discharge through their child's age 1 year (Year 1), ages 1-2 years (Year 2), and ages 2-3 years (Year 3) observation windows. Out of 270, 260, and 206 HFA mother participants in Year 1, Year 2, and Year 3 observation windows, respectively, all but one candidate in Year 1 was matched. The pre- and post-propensity score matching characteristics for maternal health care outcomes are provided in Tables B-7, B-8, and B-9.

We performed a calculation to determine the power to correctly reject null hypotheses, given sample sizes and minimum effect of differences between HFA (treatment/intervention) and non-HFA populations (control) to conclude success of the intervention. Our ability to perform the a priori power analyses was limited by the lack of existing studies; thus, outcomes to test the power based on the availability of a priori results. In particular, among birth outcomes, we chose to determine power on preterm, low birth weight, and breastfeeding intention at birth, and first year wellness visits. We used the adjusted odds ratio reported in the existing literature³⁵⁻³⁷ to obtain the expected adjusted odds ratio. We used SAS proc power to perform the calculation. The power to detect the effect described above with the probability of a Type I error was set at $\alpha=0.05$, given the samples of 209 (preterm and low birth weight) and 147 (breastfeeding) in each matched group were 0.12 (preterm), 0.13 (low birth weight), and 0.99 (breastfeeding). Similarly, for a more prevalent health care use outcome, the power to detect an adjusted odds ratio of 1.7 in the proportion of children with any wellness visits in the first year of life in the sample of 600 children per matched group was 0.49. Given the low estimated power in correctly rejecting null hypotheses for the binary outcomes, we tested the differences in birth weight and gestational weeks as numerical variables in our sensitivity analysis and modeled the average number of wellness visits as a primary outcome among child health care utilization outcomes.

Results

Evaluation Question 1 – Birth Outcomes

Preterm Birth and Birth Weight: We compared the rate of preterm birth (defined as birth before 37 weeks) between HFA enrollees with matched control. As shown in Table C-1, infants in the treatment group had significantly lower odds of being born preterm than control infants (aOR=0.13 [95% CI=0.04-0.37], $P<.001$). There were 4 infants born preterm whose mothers were enrolled in HFA compared to 28 infants in the control group. Infants whose mothers were enrolled in HFA prenatally had marginally significantly lower odds (aOR=0.47 [95% CI=0.22-1.04], $P=.06$) of being born low birth weight (LBW; defined as <2500 grams) than infants in the control group.

Maternal Intention to Breastfeed: We compared the rate of self-reported intention to breastfeed for mothers who were enrolled in HFA during their pregnancies to the matched control. As shown in Table C-1, mothers in the HFA group had significantly higher odds of reporting intention to breastfeed than control mothers (aOR=2.05 [95% CI=1.24-3.38], $P=.005$).

Evaluation Question 2 – Child Health Care Utilization and Health Outcomes

Health Care Utilization: Health care utilization from the day after the child's birth hospital discharge to age 1 (Year 1) is shown in Table C-2. Infants in HFA had significantly more use of the health care system than the non-HFA matched control group. Infants in HFA had higher rates of hospitalization in their first year of life (IRR=1.36 [95% CI=1.02-1.82], $P=.04$). Infants in HFA had significantly greater use of the ED when examining the total number of visits (IRR=1.16 [95% CI=1.01-1.34], $P=.04$), but also more non-urgent visits for evaluation and management (IRR=1.20 [95% CI=1.03-1.40], $P=.02$). Infants in HFA also had significantly greater use of all outpatient visits, including for prevention or wellness (IRR=1.10 [95% CI=1.04-1.16], $P=.001$) and non-wellness (e.g., specialty clinics or primary care visits for illness; IRR=1.12 [95% CI=1.02-1.24], $P=.02$). Infants in HFA also had a greater number of early intervention visits for speech-language pathology therapies (IRR=2.33 [95% CI=1.01-1.30], $P=.05$). Finally, infants in HFA had a significantly higher number of paid pharmacy claims than control infants (IRR=1.14 [95% CI=1.01-1.30], $P=.04$).

The utilization and health outcomes for Year 2 are shown in Table C-3. From age 1 to 2, infants in HFA had significantly greater use of the ED when examining the total number of visits (IRR=1.32 [95% CI=1.13-1.54], $P<.001$) and non-urgent visits for evaluation and management (IRR=1.35 [95% CI=1.13-1.62], $P<.001$). Infants in HFA had significantly more overall outpatient visits than the matched control group (IRR=1.22 [95% CI=1.07-1.40], $P=.004$), but there were not differences in individual categories of care. Unlike Year 1, there were not significant differences in hospitalizations or pharmacy claims.

The utilization and health outcomes for Year 3 are shown in Table C-4. From age 2 to 3, Infants in HFA had significantly higher numbers of wellness visits than the control group (IRR=1.22 [95% CI=1.03-1.44], $P=.02$). Unlike earlier observation windows, there were not significant differences between other areas of health care use.

Immunizations and Immunization Completion: The APCD does not contain records of which vaccines were administered to children during a visit in which immunizations were provided. We used the count of immunization visits seen in medical claims (including wellness visits with immunization codes) as a proxy for completion of immunization series in the first year of life. Findings are shown in Appendix B. In their first year of life (see Table C-2), HFA infants received significantly more medical visits administering immunizations than the control group and had significantly greater odds than the non-HFA matched control to have received immunizations in at least 4 medical visits (aOR=1.62 [95% CI=1.25-2.10], $P<.001$). There remained significant differences between groups in the number of visits in which immunizations occurred as children aged (see Tables B-3 and B-4). HFA infants received significantly more medical visits administering immunizations than the control group in Year 2 (IRR=1.13 [95% CI=1.05-1.23], $P=.001$) and Year 3 (IRR=1.24 [95% CI=1.09-1.42], $P=.002$).

Infant Mortality: We compared the mortality rate of HFA enrollees with matched control. The adjusted odds ratio was computed using the HFA recipients as the referent group. As shown in Table 1, we did not observe difference in the likelihood of the infant death in the treatment and control group.

Table 1. Infant Mortality Differences

Infant Mortality	Treatment (N=697)	Control (N=697)	Firth OR (95% CI) ^a	P Value
Death by Age 1 (n, %)	6 (0.01)	7 (0.01)	0.87(0.30-2.49)	0.789

^aOdds ratio is calculated by generalized linear model. Note: Reference=HFA treatment; CI= confidence interval.

Evaluation Question 3 – Maternal Health Care Utilization Outcomes

Health Care Utilization: Maternal health care utilization outcomes from the day after the birthing hospital discharge to their child’s first birthday (Year 1) are shown in Table C-5. Mothers served by HFA had significantly more use of certain types of health care than the non-HFA matched control group. Mothers in HFA had significantly greater use of the ED when examining the total number of visits (IRR=1.48 [95% CI=1.16-1.89], $P=.001$), but also more non-urgent visits for evaluation and management (IRR=1.47 [95% CI=1.09-1.98], $P=.01$). Mothers in HFA also had significantly greater use of outpatient visits. While there were not significant differences for prevention or wellness, there was for non-wellness outpatient visits (IRR=1.53 [95% CI=1.26-1.85], $P<.001$). Mothers in HFA had a greater number of health care visits in which support for mood (IRR=2.09 [95% CI=1.16-3.76], $P=.01$) and substance-related (IRR=2.21 [95% CI=1.05-4.65], $P=.04$) disorders were discussed. Finally, there was a marginally significant higher number of paid pharmacy claims for mothers in HFA than the control group (IRR=1.14 [95% CI=1.01-1.30], $P=.04$).

The maternal utilization outcomes for Year 2 are shown in Table C-6. Between the child’s age 1 to 2, mothers in HFA had significantly more overall outpatient visits (IRR=1.21 [95% CI=1.00-1.45], $P=.05$) and visits in which mood disorders were discussed than the matched control group (IRR=2.12 [95% CI=1.11-4.02], $P=.02$). There were no additional differences.

The utilization outcomes for mothers in Year 3 (child's age 2 to 3) are shown in Table C-7. Mothers in HFA had significantly more overall outpatient visits (IRR=1.39 [95% CI=1.14-1.70], $P=.001$) and non-wellness visits than the matched control group (IRR=1.32 [95% CI=1.07-1.60], $P=.01$). While there was not a significant difference in the overall number of visits, there was a significantly greater proportion of mothers in HFA (30.6%) with visits in which mood disorders were discussed compared to the control group (20.9%). Unlike earlier observation windows, there was a significant difference in the number of pharmacy claims, as well, where mothers in HFA received a greater number of prescriptions.

Discussion

The results of the HFA intervention add to the current literature on the benefits of home visiting programs. Our study expands the current literature by investigating the effects of the program on birth outcomes and health and health care utilization for children and their mothers over three years.

Results suggest that HFA positively affects the birth outcomes of infants when services are provided prenatally. When examining the birth outcomes of children whose mothers enrolled at least 3 months before the child's birth, we find that newborns in HFA had significantly lower odds of being born preterm and marginally lower odds of being born low birth weight than newborns in the control group. Being born preterm and low birth weight increase the risk of infant mortality and morbidity,³⁸ developmental delays,³⁹ and future maltreatment.⁴⁰ To our knowledge, only one other study has examined the impacts of HFA on these birth outcomes, in which the HFA program in New York demonstrated significant positive impact on birth weight, but not on preterm birth.⁴¹ Mothers in HFA also had significantly higher odds to report intention to breastfeed than those in the control group. Breastfeeding has been found positively associated with participation in other home visiting programs, such as Nurse Family Partnership (NFP) and Healthy Beginnings.^{42,43} However, we found no existing studies of HFA that examined breastfeeding as an outcome.

When we examine health care use, we find infants in HFA are significantly more likely to use health care systems than infants in the control group. Infants in HFA had a higher overall number of hospitalizations between their birth and first birthday. This difference was not observed as children age. The existing studies of the impacts of HFA on hospital admissions reported null findings.^{10,20} Indeed, the impacts of home visiting on this outcome are mixed. For example, reduced numbers of admissions or total days of admission have been documented in short-term universal postnatal home visiting⁴⁴ and in a prenatal intervention specifically for adolescent mothers.¹⁶ However, findings from NFP mostly demonstrate no effects of the intervention on hospitalizations, with one study that reported similar findings to ours—a higher number of hospital admissions in the treatment group compared to a control group.⁴⁵

Infants in HFA had a higher overall number of visits to the emergency department (overall and for evaluation and management) in their first and second years of life than children in the control group. Studies of ED use in HFA report no effect, or a similar effect as reported here, that children in the program used the ED at greater rates than the control group.⁷ This study did not appear to include the reason for the ED visit. Like our findings, results from an Infant Mental Health home visiting program for low-income families also reported increased ED use overall

and for more minor reasons.⁸ It is unclear that use of the ED for less urgent care should be considered a negative impact. Infants in HFA also had a greater number of total outpatient medical appointments from birth through age 3. Infants in HFA had greater use of wellness (Years 1 and 3) and non-wellness visits (Year 1) than non-HFA control infants. The number of well-child visits has been an outcome of interest in evaluations of HFA. Overall, studies report little impact from birth to 3,⁹⁻¹² with one study reporting impacts on well-child visits only in the child's third year of life.¹¹

An additional outpatient service we investigated was early intervention for speech-language pathology services. HFA infants received more SLP services than those in the control group in their first year of life. HFA screens children's development starting at age 2 months using the Ages and Stages Questionnaire¹³ and the Ages and Stages Questionnaire: Social-Emotional.¹⁴ Developmental screening is completed on a recurring basis every 6 months based on the child's age (at 6, 12, 18, 24, 30, 36, 42, 48, 54, and 60 months). It would appear that this developmental surveillance provided by HFA increased the use of early intervention services for speech and language therapies. The current study is the first to demonstrate positive impacts on receipt of early intervention services.⁷ Early identification and services for developmental delay puts children in HFA on a positive developmental trajectory.¹⁵

Infants in HFA were significantly more likely to have more visits in the first year of life in which immunizations were provided and to have significantly higher odds of having had at least 4 immunization visits in the first year (our proxy for having completed the immunization series) than infants in the control group. These differences in immunization were observed as children aged, with children in HFA having significantly more visits with immunizations between the ages of 1 and 2 and the ages of 2 and 3. This examination of HFA is the first to demonstrate a positive impact on immunizations,⁹⁻¹¹ though data from other home visiting interventions have demonstrated favorable impacts.¹⁶ Childhood immunizations prevent disease, thereby reducing childhood mortality and morbidity.

From birth to their child's first birthday, mothers who were served by HFA had greater use of the ED overall and for non-urgent visits than mothers in the matched-control group. HFA mothers also had a greater number of overall outpatient visits, and specifically non-wellness visits. Mothers also had a greater number of visits in which discussion of mood and substance-related disorders were discussed than the matched control group. Differences between the groups as children aged became fewer, but there remained a significant positive association between HFA and overall outpatient visits and visits that covered the topic of mood disorders in Year 2 and Year 3. Because HFA acknowledges that parent-child relational health is paramount to healthy child development,¹⁷⁻¹⁹ the intervention attends to the emotional needs of parents. HFA in Arkansas screens mothers for depression and substance use on a recurring basis (e.g., within a month of enrollment, 8 weeks of delivery and every 6 months based on their child's age) with the intention of supporting the mother with referrals for additional services. Our measurement of this dimension differs from what is typically reported in the literature (i.e., the score on behavioral health instruments). With the exception of one investigation,²⁰ the majority of studies of behavioral health in mothers served by HFA have reported null findings.^{10-12,21,22} Our findings suggest that the screening and referral is supporting mothers in HFA to discuss their mental health needs within the health care system.

Our findings contribute novel information, being among the first to document the association between HFA home visiting and medical claims related to birth, child health, and child and maternal health care use. Our results indicate the increased likelihood of positive developmental outcomes for children whose families are served by HFA. For those enrolling in pregnancy, we demonstrate more positive birth outcomes and likelihood of breastfeeding, which supports healthy development. It would also appear that the education provided by HFA increases parental support seeking for prevention, which increases the likelihood of immunization completion. We also find that parents in HFA seek medical care even for more minor reasons. Further, findings also suggest that HFA increases the likelihood of receipt of early intervention services when children are in need of developmental supports. Finally, HFA increases the mother's use of the health care system. Specifically, the supports sought for behavioral health reasons are increasingly recognized as essential for optimal relational health that would ultimately support the child's development.¹⁷⁻¹⁹ Taken together, the data present that HFA as implemented in Arkansas provides children and their families multiple benefits that improve their health and development.

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Appendix A. Sample Included in and Excluded from Propensity Score Match

Categorical variables	Category	In Sample (N= 642)	Excluded (N=370)	P
		N (%)	N (%)	
<i>Program Characteristics</i>				
Prenatal	No	245 (38.2)	142 (38.4)	0.95
	Yes	397 (61.8)	228 (61.6)	
Enrolled at Least 3 Months	No	52 (8.8)	28 (8.7)	0.96
	Yes	540 (91.2)	294 (91.3)	
	Missing	50	48	
Enrolled at Least 6 Months	No	136 (23.0)	74 (23.0)	0.99
	Yes	456 (77.0)	248 (77.0)	
	Missing	50	48	
Enrolled at Least 12 Months	No	269 (45.4)	150 (46.6)	0.74
	Yes	323 (54.6)	172 (53.4)	
	Missing	50	48	
<i>Demographics</i>				
Child Gender	Male	335 (52.2)	192 (51.9)	0.93
	Female	307 (47.8)	178 (48.1)	
Maternal Education at Enrollment	College or Beyond	76 (17.8)	35 (15.7)	0.36
	High School	328 (76.8)	170 (76.2)	
	Less than 9th Grade	23 (5.4)	18 (8.1)	
	Missing	215	147	
Maternal Education Status at Enrollment	Not a Student	239 (66.4)	122 (70.9)	0.29
	Student	121 (33.6)	50 (29.1)	
	Missing	282	198	
Maternal Race at Enrollment	Black	90 (16.1)	40 (12.1)	<0.001
	Hispanic	67 (12.0)	98 (29.7)	
	Other	19 (3.4)	11 (3.3)	
	White	384 (68.6)	181 (54.8)	
	Missing	82	40	
Maternal Marital Status at Enrollment	Married	91 (21.3)	42 (18.8)	0.47
	Not Married	337 (78.7)	181 (81.2)	
	Missing	214	147	
Maternal Employment Status at Enrollment	Employed	183 (29.9)	90 (26.4)	0.26
	Not employed	430 (70.1)	251 (73.6)	
	Missing	29	29	

Appendix B. Characteristics of Samples Pre- and Post-Propensity Score Matching

Table B-1. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Infant Birth Outcomes

Variables	Category	Unmatched (N=134,806)			PS Matched (N=418)				
		Treatment (N=209) N (%)	Control (N=134,597) N (%)	P	Treatment (N=209) N (%)	Control (N=209) N (%)	SD	VR	P
Child Gender	Male	110 (52.6)	69,025 (51.3)	0.70	110 (52.6)	110 (52.6)	0	1	1.00
	Female	99 (47.4)	65,572 (48.7)		99 (47.4)	99 (47.4)			
Mother Race	White	143 (68.4)	86,926 (64.6)	0.14	143 (68.4)	143 (68.4)	0	1	1.00
	Black	39 (18.7)	28,772 (21.4)		39 (18.7)	39 (18.7)			
	Hispanic	23 (11.0)	12,450 (9.2)		23 (11.0)	23 (11.0)			
	Others	4 (1.9)	6,449 (4.8)		4 (1.9)	4 (1.9)			
Mother Education at Birth	<High School	77 (36.8)	21,670 (16.1)	<0.001	77 (36.8)	77 (36.8)	0.06	-	0.96
	HS/Some College	125 (59.8)	83,948 (62.4)		125 (59.8)	123 (58.9)			
	College Degree	5 (2.4)	28,177 (20.9)		5 (2.4)	6 (2.9)			
	Unknown	2 (1.0)	802 (0.6)		2 (1.0)	3 (1.4)			
Mother Age at Birth	Less than 20	129 (61.7)	14,473 (10.8)	<0.001	129 (61.7)	128 (61.2)	0.02	-	0.598
	20 to 35	79 (37.8)	108,686 (80.7)		79 (37.8)	81 (38.8)			
	35-40	1 (0.5)	9,584 (7.1)		1 (0.5)	-			
	40 and above	-	1,854 (1.4)		-	-			
Mother Insurance at Birth	Medicaid	164 (78.5)	75,180 (55.9)	<0.001	164 (78.5)	161 (77.0)	0.03	-	0.93
	Private	36 (17.2)	51,130 (38.0)		36 (17.2)	39 (18.7)			
	Other	9 (4.3)	8,287 (6.2)		9 (4.3)	9 (4.3)			
Mother WIC Receipt at Birth	Yes	189 (90.4)	77,624 (57.7)	<0.001	189 (90.4)	191 (91.4)	-0.01	-	0.734
	No	20 (9.6)	54,806 (40.7)		20 (9.6)	18 (8.6)			
	Unknown	-	2,167 (1.6)		-	-			
Mother Smoking During Pregnancy	Yes	37 (17.7)	23,706 (17.6)	0.17	37 (17.7)	35 (16.7)	0.05	-	0.92
	No	125 (59.8)	87,124 (64.7)		125 (59.8)	129 (61.7)			
	Unknown	47 (22.5)	23,767 (17.7)		47 (22.5)	45 (21.5)			
Mother Married at Birth	Yes	34 (16.3)	51,885 (38.5)	<0.001	34 (16.3)	34 (16.3)	0.03	-	0.97
	No	129 (61.7)	60,170 (44.7)		129 (61.7)	131 (62.7)			
	Unknown	46 (22.0)	22,542 (16.7)		46 (22.0)	44 (21.1)			
RUCA	Urban	69 (33.0)	75,225 (55.9)	<0.001	69 (33.0)	68 (32.5)	0.03	-	0.99
	Large rural	65 (31.1)	30,237 (22.5)		65 (31.1)	67 (32.1)			
	Small rural	38 (18.2)	20,053 (14.9)		38 (18.2)	38 (18.2)			
	Isolated	37 (17.7)	9,082 (6.7)		37 (17.7)	36 (17.2)			

		Unmatched (N=134,806)			PS Matched (N=418)				
		Treatment (N=209)	Control (N=134,597)		Treatment (N=209)	Control (N=209)			
Variables	Category	N (%)	N (%)	P	N (%)	N (%)	SD	VR	P
Father Birth Date	Yes	123 (58.9)	100,272 (74.5)	<0.001	123 (58.9)	125 (59.8)	0.02	1.01	0.84
	No	86 (41.1)	34,325 (25.5)		86 (41.1)	84 (40.2)			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-2. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Breastfeeding Intention

Variables	Category	Unmatched (N=134,806)			PS Matched (N=418)				
		Treatment (N=209) N (%)	Control (N=134,597) N (%)	P	Treatment (N=209) N (%)	Control (N=209) N (%)	SD	VR	P
Mother Race	White	101 (68.7)	71,783 (64.9)	0.80	101 (68.7)	101 (68.7)	0	-	1.00
	Black	28 (19.0)	23,560 (21.3)		28 (19.0)	28 (19.0)			
	Hispanic	12 (8.2)	9,794 (8.9)		12 (8.2)	12 (8.2)			
	Others	6 (4.1)	5,512 (5.0)		6 (4.1)	6 (4.1)			
Mother Education at Birth	<High School	60 (40.8)	17,350 (15.7)	<0.001	60 (40.8)	63 (42.9)	0.15	-	0.56
	HS/Some College	81 (55.1)	67,669 (61.2)		81 (55.1)	80 (54.4)			
	College Degree	4 (2.7)	25,053 (22.6)		4 (2.7)	4 (2.7)			
	Unknown	2 (1.4)	577 (0.5)		2 (1.4)	-			
Mother Age at Birth	Less than 20	90 (61.2)	11,679 (10.6)	<0.001	90 (61.2)	91 (61.9)	0.14	-	0.80
	20 to 35	55 (37.4)	89,528 (80.9)		55 (37.4)	55 (37.4)			
	35-40	1 (0.7)	7,963 (7.2)		1 (0.7)	1 (0.7)			
	40 and above	1 (0.7)	1,479 (1.3)		1 (0.7)	-			
Mother Insurance at Birth	Medicaid	118 (80.3)	61,873 (55.9)	<0.001	118 (80.3)	116 (78.9)	0.07	-	0.86
	Private	23 (15.6)	42,694 (38.6)		23 (15.6)	26 (17.7)			
	Other	6 (4.1)	6,082 (5.5)		6 (4.1)	5 (3.4)			
Mother WIC Receipt at Birth	Yes	134 (91.2)	62,231 (56.2)	<0.001	134 (91.2)	133 (90.5)	0.03	-	0.84
	No	13 (8.8)	47,009 (42.5)		13 (8.8)	14 (9.5)			
	Unknown	-	1,409 (1.3)		-	-			
Mother Smoking During Pregnancy	Yes	25 (17.0)	19,452 (17.6)	0.21	25 (17.0)	24 (16.3)	0.05	-	0.92
	No	89 (60.5)	72,374 (65.4)		89 (60.5)	87 (59.2)			
	Unknown	33 (22.4)	18,823 (17.0)		33 (22.4)	36 (24.5)			
Mother Married at Birth	Yes	20 (13.6)	41,517 (37.5)	<0.001	20 (13.6)	19 (12.9)	0.05	-	0.91
	No	95 (64.6)	51,141 (46.2)		95 (64.6)	93 (63.3)			
	Unknown	32 (21.8)	17,991 (16.3)		32 (21.8)	35 (23.8)			
RUCA	Urban	47 (32.0)	61,957 (56.0)	<0.001	47 (32.0)	46 (31.3)	0.03	-	0.99
	Large rural	45 (30.6)	24,762 (22.4)		45 (30.6)	47 (32.0)			
	Small rural	31 (21.1)	16,495 (14.9)		31 (21.1)	30 (20.4)			
	Isolated	24 (16.3)	7,435 (6.7)		24 (16.3)	24 (16.3)			
Father Birth Date	Yes	80 (54.4)	81,606 (73.8)	<0.001	80 (54.4)	79 (53.7)	-0.01	1	0.91
	No	67 (45.6)	29,043 (26.2)		67 (45.6)	68 (46.3)			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-3. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Infant Health Care Outcomes From Birth to Age 1

Variables	Unit / Category	Unmatched (N=119,884)			PS Matched (N=1202)				
		Treatment (N=604)	Control (N=119,280)	P*	Treatment (N=601)	Control (N=601)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
APGAR: 5 Mins	Score	8.4 (1.2)	8.5 (2.6)	0.39	8.4 (1.2)	8.4 (1.3)	0.01	0.88	0.87
Gestational Weeks	Weeks	38.4 (2.2)	38.3 (1.9)	0.62	38.4 (2.2)	38.4 (2.2)	0.03	0.96	0.67
Child Hospital Stay at Birth	Days	4.5 (7.8)	4.1 (9.5)	0.28	4.4 (7.6)	4.9 (9.4)	-0.05	0.66	0.37
Birth Weight	Grams	3,167.8 (596.9)	3,227.2 (572.6)	0.01	3,172.6 (590.9)	3,155.4 (616.1)	0.03	0.92	0.62
Mother Age	Years	20.6 (4.5)	25.9 (5.6)	<0.001	20.6 (4.5)	20.6 (3.9)	0.01	1.28	0.91
Child Gender	Male	315 (52.2)	61,198 (51.3)	0.68	314 (52.2)	314 (52.2)	0	1	1.00
	Female	289 (47.8)	58,082 (48.7)		287 (47.8)	287 (47.8)			
Mother Race	White	368 (60.9)	75,908 (63.6)	0.01	367 (61.1)	367 (61.1)	0		1.00
	Black	158 (26.2)	26,586 (22.3)		157 (26.1)	157 (26.1)			
	Hispanic	64 (10.6)	11,463 (9.6)		63 (10.5)	63 (10.5)			
	Others	14 (2.3)	5,323 (4.5)		14 (2.3)	14 (2.3)			
Mother Education at Birth	<High School	212 (35.1)	19,696 (16.5)	<0.001	212 (35.3)	207 (34.4)	0.02		0.99
	HS/Some College	363 (60.1)	76,221 (63.9)		360 (59.9)	364 (60.6)			
	College Degree	24 (4.0)	22,651 (19.0)		24 (4.0)	25 (4.2)			
	Unknown	5 (0.8)	712 (0.6)		5 (0.8)	5 (0.8)			
Mother Insurance at Birth	Medicaid	461 (76.3)	68,820 (57.7)	<0.001	459 (76.4)	442 (73.5)	0.05		0.44
	Private	114 (18.9)	43,046 (36.1)		113 (18.8)	122 (20.3)			
	Other	29 (4.8)	7,414 (6.2)		29 (4.8)	37 (6.2)			
RUCA	Urban	239 (39.6)	66,107 (55.4)	<0.001	238 (39.6)	253 (42.1)	0.05		0.83
	Large Rural	149 (24.7)	26,963 (22.6)		149 (24.8)	139 (23.1)			
	Small Rural	117 (19.4)	18,016 (15.1)		115 (19.1)	112 (18.6)			
	Isolated	99 (16.4)	8,194 (6.9)		99 (16.5)	97 (16.1)			
Mother Smoking During Pregnancy	Yes	114 (18.9)	21,418 (18.0)	<0.001	112 (18.6)	114 (19.0)	0.02		0.833
	No	327 (54.1)	76,699 (64.3)		326 (54.2)	316 (52.6)			
	Unknown	163 (27.0)	21,163 (17.7)		163 (27.1)	171 (28.5)			

		Unmatched (N=119,884)			PS Matched (N=1202)				
		Treatment (N=604)	Control (N=119,280)		Treatment (N=601)	Control (N=601)			
Variables	Unit / Category	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
Mother Married at Birth	Yes	87 (14.4)	44,433 (37.3)	<0.001	86 (14.3)	76 (12.6)	0.06		0.694
	No	361 (59.8)	54,782 (45.9)		359 (59.7)	364 (60.6)			
	Unknown	156 (25.8)	20,065 (16.8)		156 (26.0)	161 (26.8)			
Had Father Birth Date	Yes	331 (54.8)	88,016 (73.8)	<0.001	330 (54.9)	303 (50.4)	-0.1	0.99	0.119
	No	273 (45.2)	31,264 (26.2)		271 (45.1)	298 (49.6)			
Mother WIC Receipt at Birth	Yes	502 (83.1)	71,637 (60.1)	<0.001	500 (83.2)	492 (81.9)	0.08	-	0.696
	No	95 (15.7)	45,718 (38.3)		94 (15.6)	99 (16.5)			
	Unknown	7 (1.2)	1,925 (1.6)		7 (1.2)	10 (1.7)			
Gestational Age: Preterm	Normal	540 (89.4)	106,876 (89.6)	0.736	539 (89.7)	539 (89.7)	0	1	1.00
	Preterm	64 (10.6)	12,293 (10.3)		62 (10.3)	62 (10.3)			
	Missing	-	111 (0.1)		-	-			
Mother Age Category	Less Than 20	303 (50.2)	13,156 (11.0)	<0.001	301 (50.1)	298 (49.6)	0.14	-	0.953
	20 To 35	291 (48.2)	96,254 (80.7)		290 (48.3)	295 (49.1)			
	35-40	7 (1.2)	8,252 (6.9)		7 (1.2)	6 (1.0)			
	40 And Above	3 (0.5)	1,618 (1.4)		3 (0.5)	2 (0.3)			
Delivery Method	Vaginal	394 (65.2)	75,574 (63.4)	0.030	392 (65.2)	392 (65.2)	0.14	-	0.384
	C-Section	175 (29.0)	39,309 (33.0)		174 (29.0)	175 (29.1)			
	Vacuum	28 (4.6)	3,633 (3.0)		28 (4.7)	32 (5.3)			
	Forceps	7 (1.2)	763 (0.6)		7 (1.2)	2 (0.3)			
	Missing	-	1 (0.0)		-	-			
Birth Weight Category	Normal	538 (89.1)	109,075 (91.4)	0.103	537 (89.4)	536 (89.2)	0.07	-	0.83
	Low	53 (8.8)	8,710 (7.3)		52 (8.7)	50 (8.3)			
	Very Low	13 (2.2)	1,483 (1.2)		12 (2.0)	15 (2.5)			
	Missing	-	12 (0.0)		-	-			
Child Hospital Length at Birth	< 5 Days	530 (87.7)	106,472 (89.3)	0.026	529 (88.0)	537 (89.4)	0.2	-	0.396
	5-< 10 Days	34 (5.6)	6,321 (5.3)		34 (5.7)	21 (3.5)			
	10 -< 21 Days	22 (3.6)	3,756 (3.1)		21 (3.5)	20 (3.3)			
	21 -< 47 Days	10 (1.7)	2,160 (1.8)		10 (1.7)	13 (2.2)			
	47 =< 94 Days	8 (1.3)	502 (0.4)		7 (1.2)	10 (1.7)			
	> 94 Days	-	69 (0.1)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-4. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Infant Health Care Outcomes From Age 1 to 2

Variables	Unit / Category	Unmatched (N=80,234)			PS Matched (N=964)				
		Treatment (N=485)	Control (N=79,749)	P*	Treatment (N=482)	Control (N=482)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
APGAR: 5 Mins	Score	8.4 (1.3)	8.5 (2.8)	0.44	8.4 (1.3)	8.4 (1.2)	-0.03	1.14	0.83
Gestational Weeks	Weeks	38.4 (2.3)	38.3 (2.0)	0.81	38.4 (2.2)	38.5 (1.8)	0.04	0.96	0.78
Child Hospital Stay at Birth	Days	4.6 (7.8)	4.2 (10.7)	0.38	4.4 (7.0)	3.9 (4.5)	-0.02	0.81	0.20
Birth Weight	Grams	3,173.2 (609.4)	3,226.9 (579.6)	0.04	3,184.6 (591.2)	3,201.2 (545.7)	0.01	0.97	0.65
Mother Age	Years	20.7 (4.6)	26.0 (5.6)	<0.001	20.7 (4.6)	20.6 (4.1)	0	1.33	0.82
Child Gender	Male	260 (53.6)	41,180 (51.6)	0.39	259 (53.7)	259 (53.7)	0	1	1
	Female	225 (46.4)	38,569 (48.4)		223 (46.3)	223 (46.3)			
Mother Race	White	292 (60.2)	50,885 (63.8)	0.06	291 (60.4)	291 (60.4)	0	-	1
	Black	129 (26.6)	17,972 (22.5)		128 (26.6)	128 (26.6)			
	Hispanic	52 (10.7)	7,794 (9.8)		51 (10.6)	51 (10.6)			
	Others	12 (2.5)	3,098 (3.9)		12 (2.5)	12 (2.5)			
Mother Education at Birth	<High School	170 (35.1)	13,140 (16.5)	<0.001	170 (35.3)	158 (32.8)	0.04	-	0.88
	HS/Some College	292 (60.2)	50,724 (63.6)		289 (60.0)	300 (62.2)			
	College Degree	18 (3.7)	15,455 (19.4)		18 (3.7)	19 (3.9)			
	Unknown	5 (1.0)	430 (0.5)		5 (1.0)	5 (1.0)			
Mother Insurance at Birth	Medicaid	366 (75.5)	44,802 (56.2)	<0.001	364 (75.5)	360 (74.7)	0.04	-	0.90
	Private	95 (19.6)	29,580 (37.1)		94 (19.5)	95 (19.7)			
	Other	24 (4.9)	5,367 (6.7)		24 (5.0)	27 (5.6)			
RUCA	Urban	195 (40.2)	43,747 (54.9)	<0.001	194 (40.2)	200 (41.5)	0.13	-	0.27
	Large Rural	122 (25.2)	18,107 (22.7)		122 (25.3)	117 (24.3)			
	Small Rural	93 (19.2)	12,355 (15.5)		91 (18.9)	73 (15.1)			
	Isolated	75 (15.5)	5,540 (6.9)		75 (15.6)	92 (19.1)			
Mother Smoking During Pregnancy	Yes	80 (16.5)	12,987 (16.3)	0.002	78 (16.2)	80 (16.6)	0	-	0.98
	No	261 (53.8)	48,283 (60.5)		260 (53.9)	258 (53.5)			
	Unknown	144 (29.7)	18,479 (23.2)		144 (29.9)	144 (29.9)			
Mother Married at Birth	Yes	64 (13.2)	28,279 (35.5)	<0.001	63 (13.1)	55 (11.4)	0.06	-	0.73
	No	284 (58.6)	33,798 (42.4)		282 (58.5)	288 (59.8)			
	Unknown	137 (28.2)	17,672 (22.2)		137 (28.4)	139 (28.8)			
	Yes	261 (53.8)	59,187 (74.2)	<0.001	260 (53.9)	266 (55.2)	0.03	1	0.70

		Unmatched (N=80,234)			PS Matched (N=964)				
		Treatment (N=485)	Control (N=79,749)		Treatment (N=482)	Control (N=482)			
Variables	Unit / Category	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
Had Father Birth Date	No	224 (46.2)	20,562 (25.8)		222 (46.1)	216 (44.8)			
Mother WIC Receipt at Birth	Yes	407 (83.9)	49,141 (61.6)	<0.001	405 (84.0)	410 (85.1)	0.03	-	0.89
	No	72 (14.8)	29,250 (36.7)		71 (14.7)	67 (13.9)			
	Unknown	6 (1.2)	1,358 (1.7)		6 (1.2)	5 (1.0)			
Gestational Age: Preterm	Normal	429 (88.5)	71,391 (89.5)	0.54	428 (88.8)	432 (89.6)	-0.03	1.07	0.68
	Preterm	56 (11.5)	8,273 (10.4)		54 (11.2)	50 (10.4)			
	Missing	-	85 (0.1)		-	-			
Mother Age Category	Less Than 20	243 (50.1)	8,633 (10.8)	<0.001	241 (50.0)	238 (49.4)	0.02	-	0.77
	20 To 35	234 (48.2)	64,440 (80.8)		233 (48.3)	237 (49.2)			
	35-40	5 (1.0)	5,560 (7.0)		5 (1.0)	6 (1.2)			
	40 And Above	3 (0.6)	1,116 (1.4)		3 (0.6)	1 (0.2)			
Delivery Method	Vaginal	317 (65.4)	50,579 (63.4)	0.09	315 (65.4)	298 (61.8)	0.09	-	0.64
	C-Section	141 (29.1)	26,310 (33.0)		140 (29.0)	158 (32.8)			
	Vacuum	23 (4.7)	2,337 (2.9)		23 (4.8)	23 (4.8)			
	Forceps	4 (0.8)	522 (0.7)		4 (0.8)	3 (0.6)			
	Missing	-	1 (0.0)		-	-			
Birth Weight Category	Normal	430 (88.7)	72,829 (91.3)	0.15	429 (89.0)	433 (89.8)	0.04	-	0.72
	Low	44 (9.1)	5,822 (7.3)		43 (8.9)	37 (7.7)			
	Very Low	11 (2.3)	1,092 (1.4)		10 (2.1)	12 (2.5)			
	Missing	-	6 (0.0)		-	-			
Child Hospital Length at Birth	< 5 Days	423 (87.2)	71,137 (89.2)	0.06	422 (87.6)	423 (87.8)	0.15	-	0.99
	5-< 10 Days	27 (5.6)	4,181 (5.2)		27 (5.6)	24 (5.0)			
	10 -< 21 Days	19 (3.9)	2,503 (3.1)		18 (3.7)	18 (3.7)			
	21 -< 47 Days	9 (1.9)	1,482 (1.9)		9 (1.9)	10 (2.1)			
	47 =< 94 Days	7 (1.4)	390 (0.5)		6 (1.2)	7 (1.5)			
	> 94 Days	-	56 (0.1)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-5. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Infant Health Care Outcomes From Age 2 to 3

Variables	Unit / Category	Unmatched (N=62,812)			PS Matched (N=782)				
		Treatment (N=395)	Control (N=62,417)	P*	Treatment (N=391)	Control (N=391)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
APGAR: 5 Mins	Score	8.4 (1.2)	8.4 (3.1)	0.58	8.4 (1.2)	8.4 (1.3)	0	0.92	1.00
Gestational Weeks	Weeks	38.4 (2.4)	38.4 (2.0)	0.62	38.5 (2.2)	38.6 (1.9)	-0.05	1.33	0.47
Child Hospital Stay at Birth	Days	4.6 (8.3)	4.2 (11.8)	0.44	4.4 (7.3)	4.2 (8.6)	0.01	0.73	0.80
Birth Weight	Grams	3,163.2 (617.2)	3,226.9 (579.8)	0.03	3,177.1 (595.4)	3,193.8 (530.8)	-0.03	1.26	0.68
Mother Age	Years	20.8 (4.7)	25.9 (5.6)	<0.001	20.8 (4.7)	20.9 (4.5)	-0.01	1.11	0.85
Child Gender	Male	203 (51.4)	32,300 (51.7)	0.89	201 (51.4)	201 (51.4)	0	1	1
	Female	192 (48.6)	30,117 (48.3)		190 (48.6)	190 (48.6)			
Mother Race	White	234 (59.2)	39,987 (64.1)	0.19	234 (59.8)	234 (59.8)	0	-	1
	Black	107 (27.1)	14,424 (23.1)		106 (27.1)	106 (27.1)			
	Hispanic	42 (10.6)	5,911 (9.5)		40 (10.2)	40 (10.2)			
	Others	12 (3.0)	2,095 (3.4)		11 (2.8)	11 (2.8)			
Mother Education at Birth	<High School	137 (34.7)	10,477 (16.8)	<0.001	135 (34.5)	137 (35.0)	0.14	-	0.99
	HS/Some College	235 (59.5)	39,691 (63.6)		233 (59.6)	231 (59.1)			
	College Degree	18 (4.6)	11,935 (19.1)		18 (4.6)	18 (4.6)			
	Unknown	5 (1.3)	314 (0.5)		5 (1.3)	5 (1.3)			
Mother Insurance at Birth	Medicaid	298 (75.4)	34,818 (55.8)	<0.001	294 (75.2)	301 (77.0)	0.05	-	0.84
	Private	76 (19.2)	22,965 (36.8)		76 (19.4)	70 (17.9)			
	Other	21 (5.3)	4,634 (7.4)		21 (5.4)	20 (5.1)			
RUCA	Urban	164 (41.5)	33,979 (54.4)	<0.001	163 (41.7)	151 (38.6)	0.09	-	0.62
	Large Rural	101 (25.6)	14,285 (22.9)		100 (25.6)	104 (26.6)			
	Small Rural	72 (18.2)	9,762 (15.6)		71 (18.2)	67 (17.1)			
	Isolated	58 (14.7)	4,391 (7.0)		57 (14.6)	69 (17.6)			
Mother Smoking During Pregnancy	Yes	62 (15.7)	9,836 (15.8)	0.28	60 (15.3)	65 (16.6)	0.07	-	0.63
	No	209 (52.9)	35,176 (56.4)		207 (52.9)	214 (54.7)			
	Unknown	124 (31.4)	17,405 (27.9)		124 (31.7)	112 (28.6)			
Mother Married at Birth	Yes	49 (12.4)	20,518 (32.9)	<0.001	49 (12.5)	55 (14.1)	0.05	-	0.63
	No	227 (57.5)	25,149 (40.3)		223 (57.0)	228 (58.3)			

		Unmatched (N=62,812)			PS Matched (N=782)				
		Treatment (N=395)	Control (N=62,417)		Treatment (N=391)	Control (N=391)			
Variables	Unit / Category	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
	Unknown	119 (30.1)	16,750 (26.8)		119 (30.4)	108 (27.6)			
Had Father Birth Date	Yes	215 (54.4)	46,069 (73.8)	<0.001	215 (55.0)	217 (55.5)	0.01	1	0.89
	No	180 (45.6)	16,348 (26.2)		176 (45.0)	174 (44.5)			
Mother WIC Receipt at Birth	Yes	337 (85.3)	39,338 (63.0)	<0.001	335 (85.7)	342 (87.5)	0.03	-	0.76
	No	53 (13.4)	21,943 (35.2)		51 (13.0)	45 (11.5)			
	Unknown	5 (1.3)	1,136 (1.8)		5 (1.3)	4 (1.0)			
Gestational Age: Preterm	Normal	351 (88.9)	55,958 (89.7)	0.68	350 (89.5)	350 (89.5)	0	1	1
	Preterm	44 (11.1)	6,389 (10.2)		41 (10.5)	41 (10.5)			
	Missing	-	70 (0.1)		-	-			
Mother Age Category	Less Than 20	193 (48.9)	7,009 (11.2)	<0.001	189 (48.3)	191 (48.8)	0.17	-	0.96
	20 To 35	194 (49.1)	50,364 (80.7)		194 (49.6)	190 (48.6)			
	35-40	5 (1.3)	4,210 (6.7)		5 (1.3)	6 (1.5)			
	40 And Above	3 (0.8)	834 (1.3)		3 (0.8)	4 (1.0)			
Delivery Method	Vaginal	253 (64.1)	39,814 (63.8)	0.001	251 (64.2)	265 (67.8)	0.14	-	0.50
	C-Section	113 (28.6)	20,303 (32.5)		111 (28.4)	106 (27.1)			
	Vacuum	26 (6.6)	1,890 (3.0)		26 (6.6)	17 (4.3)			
	Forceps	3 (0.8)	409 (0.7)		3 (0.8)	3 (0.8)			
	Missing	-	1 (0.0)		-	-			
Birth Weight Category	Normal	348 (88.1)	56,991 (91.3)	0.09	347 (88.7)	361 (92.3)	0.11	-	0.15
	Low	37 (9.4)	4,567 (7.3)		36 (9.2)	27 (6.9)			
	Very Low	10 (2.5)	855 (1.4)		8 (2.0)	3 (0.8)			
	Missing	-	4 (0.0)		-	-			
Child Hospital Length at Birth	< 5 Days	347 (87.8)	55,772 (89.4)	0.02	346 (88.5)	358 (91.6)	0.15	-	0.67
	5-< 10 Days	21 (5.3)	3,177 (5.1)		21 (5.4)	15 (3.8)			
	10 -< 21 Days	13 (3.3)	1,976 (3.2)		12 (3.1)	8 (2.0)			
	21 -< 47 Days	7 (1.8)	1,136 (1.8)		7 (1.8)	5 (1.3)			
	47 =< 94 Days	7 (1.8)	312 (0.5)		5 (1.3)	5 (1.3)			
	> 94 Days	-	44 (0.1)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-6. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Infant Mortality

Variables	Unit / Category	Unmatched (N=62,812)			PS Matched (N=782)				
		Treatment (N=395)	Control (N=62,417)	P*	Treatment (N=391)	Control (N=391)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
APGAR: 5 Mins	Score	8.4 (1.2)	8.5 (2.7)	0.27	8.4 (1.2)	8.4 (1.3)	0.01	0.86	0.69
Gestational Weeks	Weeks	38.4 (2.3)	38.4 (2.0)	0.70	38.4 (2.2)	38.4 (2.2)	0	1.03	0.94
Child Hospital Stay at Birth	Days	4.5 (7.7)	4.1 (10.3)	0.35	4.4 (7.5)	4.2 (6.5)	-	-	0.70
Birth Weight	Grams	3,155.6 (591.9)	3,258.5 (579.4)	<0.001	3,159.4 (587.1)	3,126.4 (583.9)	0.06	1.01	0.29
Mother Age	Years	20.7 (4.5)	26.9 (5.7)	<0.001	20.7 (4.5)	20.8 (4.3)	-0.02	1.11	0.66
Child Gender	Male	365 (52.1)	103,537 (51.1)	0.62	363 (52.1)	363 (52.1)	0	1	1
	Female	336 (47.9)	98,924 (48.9)		334 (47.9)	334 (47.9)			
Mother Race	White	422 (60.2)	134,357 (66.4)	<0.001	421 (60.4)	421 (60.4)	0		1.000
	Black	173 (24.7)	34,357 (17.0)		172 (24.7)	172 (24.7)			
	Hispanic	85 (12.1)	21,823 (10.8)		84 (12.1)	84 (12.1)			
	Others	21 (3.0)	11,924 (5.9)		20 (2.9)	20 (2.9)			
Mother Education at Birth	<High School	248 (35.4)	29,727 (14.7)	<0.001	247 (35.4)	243 (34.9)	0.12		0.30
	HS/Some College	421 (60.1)	113,100 (55.9)		418 (60.0)	430 (61.7)			
	College Degree	27 (3.9)	58,240 (28.8)		27 (3.9)	16 (2.3)			
	Unknown	5 (0.7)	1,394 (0.7)		5 (0.7)	8 (1.1)			
Mother Insurance at Birth	Medicaid	531 (75.7)	91,340 (45.1)	<0.001	528 (75.8)	543 (77.9)	0.05		0.64
	Private	132 (18.8)	96,593 (47.7)		131 (18.8)	119 (17.1)			
	Other	38 (5.4)	14,528 (7.2)		38 (5.5)	35 (5.0)			
RUCA	Urban	286 (40.8)	119,639 (59.1)	<0.001	285 (40.9)	277 (39.7)	0		0.95
	Large Rural	166 (23.7)	41,426 (20.5)		166 (23.8)	164 (23.5)			
	Small Rural	131 (18.7)	29,605 (14.6)		129 (18.5)	135 (19.4)			
	Isolated	118 (16.8)	11,791 (5.8)		117 (16.8)	121 (17.4)			
Mother Smoking During Pregnancy	Yes	128 (18.3)	29,139 (14.4)	<0.001	125 (17.9)	134 (19.2)	0.04		0.68
	No	385 (54.9)	136,784 (67.6)		384 (55.1)	368 (52.8)			
	Unknown	188 (26.8)	36,538 (18.0)		188 (27.0)	195 (28.0)			
	Yes	99 (14.1)	94,169 (46.5)	<0.001	98 (14.1)	112 (16.1)	0.07		0.41

Variables	Unit / Category	Unmatched (N=62,812)			PS Matched (N=782)				
		Treatment (N=395) Mean (SE) / N (%)	Control (N=62,417) Mean (SE) / N (%)	P*	Treatment (N=391) Mean (SE) / N (%)	Control (N=391) Mean (SE) / N (%)	SD	VR	P
Mother Married at Birth	No	422 (60.2)	73,657 (36.4)		419 (60.1)	396 (56.8)			
	Unknown	180 (25.7)	34,635 (17.1)		180 (25.8)	189 (27.1)			
Had Father Birth Date	Yes	389 (55.5)	161,099 (79.6)	<0.001	388 (55.7)	401 (57.5)	0.04	1.01	0.48
	No	312 (44.5)	41,362 (20.4)		309 (44.3)	296 (42.5)			
Mother WIC Receipt at Birth	Yes	575 (82.0)	95,984 (47.4)	<0.001	572 (82.1)	577 (82.8)	0.03		0.94
	No	117 (16.7)	103,168 (51.0)		116 (16.6)	111 (15.9)			
	Unknown	9 (1.3)	3,309 (1.6)		9 (1.3)	9 (1.3)			
Gestational Age: Preterm	Normal	628 (89.6)	185 (0.1)	0.61	626 (89.8)	626 (89.8)	0	1	1.000
	Preterm	73 (10.4)	182,569 (90.2)		71 (10.2)	71 (10.2)			
	Missing	-	19,707 (9.7)		-	-			
Mother Age Category	Less Than 20	354 (50.5)	17,527 (8.7)	<0.001	351 (50.4)	346 (49.6)	0.16		0.93
	20 To 35	334 (47.6)	163,849 (80.9)		333 (47.8)	335 (48.1)			
	35-40	10 (1.4)	17,489 (8.6)		10 (1.4)	13 (1.9)			
	40 And Above	3 (0.4)	3,596 (1.8)		3 (0.4)	3 (0.4)			
Delivery Method	Vaginal	467 (66.6)	65,210 (32.2)	0.002	464 (66.6)	442 (63.4)	0.08		0.53
	C-Section	193 (27.5)	5,800 (2.9)		192 (27.5)	215 (30.8)			
	Vacuum	34 (4.9)	1,232 (0.6)		34 (4.9)	31 (4.4)			
	Forceps	7 (1.0)	5 (0.0)		7 (1.0)	9 (1.3)			
	Missing	-	130,214 (64.3)		-	-			
Birth Weight Category	Normal	624 (89.0)	13,224 (6.5)	0.01	622 (89.2)	626 (89.8)	0.04		0.88
	Low	61 (8.7)	2,612 (1.3)		60 (8.6)	55 (7.9)			
	Very Low	16 (2.3)	31 (0.0)		15 (2.2)	16 (2.3)			
	Missing	-	186,594 (92.2)		-	-			
Child Hospital Length at Birth	< 5 Days	622 (88.7)	188,051 (92.9)	<0.001	620 (89.0)	617 (88.5)	0.18		0.78
	5-< 10 Days	37 (5.3)	7,147 (3.5)		37 (5.3)	46 (6.6)			
	10 -< 21 Days	22 (3.1)	4,227 (2.1)		21 (3.0)	20 (2.9)			
	21 -< 47 Days	12 (1.7)	2,402 (1.2)		12 (1.7)	9 (1.3)			
	47 =< 94 Days	8 (1.1)	552 (0.3)		7 (1.0)	5 (0.7)			
	> 94 Days	-	82 (0.0)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-7. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Maternal Health Care Outcomes From Birth to Child’s Age 1

Variables	Unit / Category	Unmatched (N=57,340)			PS Matched (N=538)				
		Treatment (N=270) Mean (SE) / N (%)	Control (N=57,070) Mean (SE) / N (%)	P*	Treatment (N=269) Mean (SE) / N (%)	Control (N=269) Mean (SE) / N (%)	SD	VR	P
Mother Hospital Stay at Birth	Days	3.0 (5.6)	2.9 (4.8)	0.57	2.7 (0.9)	2.7 (0.8)	0.02	1.22	0.80
Mother Race	White	158 (58.5)	37,967 (66.5)	<0.001	158 (58.7)	158 (58.7)	0	-	1.000
	Black	77 (28.5)	14,147 (24.8)		76 (28.3)	76 (28.3)			
	Hispanic	28 (10.4)	3,103 (5.4)		28 (10.4)	28 (10.4)			
	Others	7 (2.6)	1,853 (3.2)		7 (2.6)	7 (2.6)			
Mother Education at Birth	<High School	101 (37.4)	8,819 (15.5)	<0.001	100 (37.2)	95 (35.3)	0.1	-	0.93
	HS/Some College	160 (59.3)	34,307 (60.1)		160 (59.5)	166 (61.7)			
	College Degree	6 (2.2)	13,635 (23.9)		6 (2.2)	6 (2.2)			
	Unknown	3 (1.1)	309 (0.5)		3 (1.1)	2 (0.7)			
Mother Insurance at Birth	Medicaid	203 (75.2)	31,524 (55.2)	<0.001	202 (75.1)	202 (75.1)	0.04	-	0.93
	Private	48 (17.8)	22,462 (39.4)		48 (17.8)	46 (17.1)			
	Other	19 (7.0)	3,084 (5.4)		19 (7.1)	21 (7.8)			
RUCA	Urban	110 (40.7)	31,653 (55.5)	<0.001	109 (40.5)	107 (39.8)	0.03	-	0.99
	Large Rural	61 (22.6)	12,850 (22.5)		61 (22.7)	60 (22.3)			
	Small Rural	58 (21.5)	8,748 (15.3)		58 (21.6)	58 (21.6)			
	Isolated	41 (15.2)	3,819 (6.7)		41 (15.2)	44 (16.4)			
Mother Smoking During Pregnancy	Yes	51 (18.9)	10,809 (18.9)	<0.001	51 (19.0)	49 (18.2)	0.03	-	0.97
	No	150 (55.6)	36,721 (64.3)		150 (55.8)	152 (56.5)			
	Unknown	69 (25.6)	9,540 (16.7)		68 (25.3)	68 (25.3)			
Mother Married at Birth	Yes	27 (10.0)	20,193 (35.4)	<0.001	27 (10.0)	24 (8.9)	0.03	-	0.90
	No	177 (65.6)	27,877 (48.8)		177 (65.8)	180 (66.9)			
	Unknown	66 (24.4)	9,000 (15.8)		65 (24.2)	65 (24.2)			
Had Father Birth Date	Yes	129 (47.8)	40,562 (71.1)	<0.001	129 (48.0)	133 (49.4)	-0.02	1	0.73
	No	141 (52.2)	16,508 (28.9)		140 (52.0)	136 (50.6)			
Mother Age Category	Less Than 20	142 (52.6)	6,271 (11.0)	<0.001	141 (52.4)	142 (52.8)	0.14	-	0.99
	20 To 35	127 (47.0)	46,060 (80.7)		127 (47.2)	126 (46.8)			
	35-40	1 (0.4)	4,024 (7.1)		1 (0.4)	1 (0.4)			
	40 And Above	-	715 (1.3)		-	-			
Mother WIC Receipt at Birth	Yes	218 (80.7)	31,752 (55.6)	<0.001	217 (80.7)	221 (82.2)	0.08	-	0.75
	No	47 (17.4)	24,429 (42.8)		47 (17.5)	45 (16.7)			
	Unknown	5 (1.9)	889 (1.6)		5 (1.9)	3 (1.1)			

		Unmatched (N=57,340)			PS Matched (N=538)				
		Treatment (N=270)	Control (N=57,070)		Treatment (N=269)	Control (N=269)			
Variables	Unit / Category	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
Mother Hospital Length at Birth	< 5 Days	261 (96.7)	55,714 (97.6)	0.141	261 (97.0)	265 (98.5)	-0.1	-	0.243
	5-< 10 Days	8 (3.0)	1,132 (2.0)		8 (3.0)	4 (1.5)			
	10 -< 21 Days	1 (0.4)	96 (0.2)		-	-			
	21 -< 47 Days	-	54 (0.1)		-	-			
	47 =< 94 Days	-	48 (0.1)		-	-			
	> 94 Days	-	26 (0.0)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-8. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Maternal Health Care Outcomes From Child’s Age 1 to 2

Variables	Unit	Unmatched (N=45,797)			PS Matched (N=520)				
		Treatment (N=260)	Control (N=45,537)	P*	Treatment (N=260)	Control (N=260)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
Mother Hospital Stay at Birth	Days	2.7 (0.8)	2.9 (5.1)	0.60	2.7 (0.8)	2.7 (0.8)	0.03	1.14	0.75
Mother Race	White	147 (56.5)	30,481 (66.9)	0.003	147 (56.5)	147 (56.5)	0	-	1.000
	Black	86 (33.1)	11,430 (25.1)		86 (33.1)	86 (33.1)			
	Hispanic	20 (7.7)	2,372 (5.2)		20 (7.7)	20 (7.7)			
	Others	7 (2.7)	1,254 (2.8)		7 (2.7)	7 (2.7)			
Mother Education at Birth	<High School	92 (35.4)	6,993 (15.4)	<0.001	92 (35.4)	97 (37.3)	0.11	-	0.93
	HS/Some College	158 (60.8)	27,445 (60.3)		158 (60.8)	153 (58.8)			
	College Degree	7 (2.7)	10,875 (23.9)		7 (2.7)	6 (2.3)			
	Unknown	3 (1.2)	224 (0.5)		3 (1.2)	4 (1.5)			
Mother Insurance at Birth	Medicaid	204 (78.5)	24,823 (54.5)	<0.001	204 (78.5)	212 (81.5)	0.11	-	0.64
	Private	39 (15.0)	17,870 (39.2)		39 (15.0)	35 (13.5)			
	Other	17 (6.5)	2,844 (6.2)		17 (6.5)	13 (5.0)			
RUCA	Urban	107 (41.2)	25,259 (55.5)	<0.001	107 (41.2)	105 (40.4)	0.03	-	0.99
	Large Rural	58 (22.3)	10,249 (22.5)		58 (22.3)	60 (23.1)			
	Small Rural	57 (21.9)	6,967 (15.3)		57 (21.9)	55 (21.2)			
	Isolated	38 (14.6)	3,062 (6.7)		38 (14.6)	40 (15.4)			
Mother Smoking During Pregnancy	Yes	42 (16.2)	8,021 (17.6)	0.28	42 (16.2)	43 (16.5)	0.07	-	0.83
	No	151 (58.1)	27,623 (60.7)		151 (58.1)	156 (60.0)			
	Unknown	67 (25.8)	9,893 (21.7)		67 (25.8)	61 (23.5)			
Mother Married at Birth	Yes	25 (9.6)	15,770 (34.6)	<0.001	25 (9.6)	26 (10.0)	0.05	-	0.83
	No	170 (65.4)	20,374 (44.7)		170 (65.4)	175 (67.3)			
	Unknown	65 (25.0)	9,393 (20.6)		65 (25.0)	59 (22.7)			
Had Father Birth Date	Yes	125 (48.1)	32,506 (71.4)	<0.001	125 (48.1)	125 (48.1)	0	1	1.000
	No	135 (51.9)	13,031 (28.6)		135 (51.9)	135 (51.9)			
Mother Age Category	Less Than 20	143 (55.0)	5,042 (11.1)	<0.001	143 (55.0)	142 (54.6)	0.14	-	0.90
	20 To 35	114 (43.8)	36,824 (80.9)		114 (43.8)	116 (44.6)			
	35-40	3 (1.2)	3,105 (6.8)		3 (1.2)	2 (0.8)			
	40 And Above	-	566 (1.2)		-	-			
Mother WIC Receipt at Birth	Yes	225 (86.5)	25,980 (57.1)	<0.001	225 (86.5)	223 (85.8)	0.03		0.97
	No	32 (12.3)	18,779 (41.2)		32 (12.3)	34 (13.1)			
	Unknown	3 (1.2)	778 (1.7)		3 (1.2)	3 (1.2)			

		Unmatched (N=45,797)			PS Matched (N=520)				
		Treatment (N=260)	Control (N=45,537)		Treatment (N=260)	Control (N=260)			
Variables	Unit	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
Mother Hospital Length at Birth	< 5 Days	253 (97.3)	44,466 (97.6)	0.88	253 (97.3)	256 (98.5)	-0.08	-	0.36
	5-< 10 Days	7 (2.7)	886 (1.9)		7 (2.7)	4 (1.5)			
	10 -< 21 Days	-	76 (0.2)		-	-			
	21 -< 47 Days	-	54 (0.1)		-	-			
	47 =< 94 Days	-	36 (0.1)		-	-			
	> 94 Days	-	19 (0.0)		-	-			

Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio

Table B-9. Healthy Families America Treatment and Control Group Characteristics, Pre- and Post-Propensity Score Matching — Maternal Health Care Outcomes From Child’s Age 2 to 3

Variables	Unit	Unmatched (N=35,398)			PS Matched (N=412)				
		Treatment (N=206)	Control (N=35,192)	P*	Treatment (N=206)	Control (N=206)	SD	VR	P
		Mean (SE) / N (%)	Mean (SE) / N (%)		Mean (SE) / N (%)	Mean (SE) / N (%)			
Mother Hospital Stay at Birth	Days	2.7 (0.8)	2.8 (3.1)	0.45	2.7 (0.8)	2.6 (0.7)	0.06	1.02	0.42
Mother Race	White	116 (56.3)	23,404 (66.5)	0.01	116 (56.3)	116 (56.3)	0	-	1.00
	Black	68 (33.0)	9,143 (26.0)		68 (33.0)	68 (33.0)			
	Hispanic	17 (8.3)	1,734 (4.9)		17 (8.3)	17 (8.3)			
	Others	5 (2.4)	911 (2.6)		5 (2.4)	5 (2.4)			
Mother Education at Birth	<High School	79 (38.3)	5,337 (15.2)	<0.001	79 (38.3)	77 (37.4)	0.02	-	0.94
	HS/Some College	119 (57.8)	21,222 (60.3)		119 (57.8)	122 (59.2)			
	College Degree	6 (2.9)	8,478 (24.1)		6 (2.9)	6 (2.9)			
	Unknown	2 (1.0)	155 (0.4)		2 (1.0)	1 (0.5)			
Mother Insurance at Birth	Medicaid	159 (77.2)	18,688 (53.1)	<0.001	159 (77.2)	164 (79.6)	0.1	-	0.66
	Private	34 (16.5)	14,023 (39.8)		34 (16.5)	33 (16.0)			
	Other	13 (6.3)	2,481 (7.0)		13 (6.3)	9 (4.4)			
RUCA	Urban	91 (44.2)	19,353 (55.0)	<0.001	91 (44.2)	95 (46.1)	0.09	-	0.91
	Large Rural	45 (21.8)	7,930 (22.5)		45 (21.8)	45 (21.8)			
	Small Rural	40 (19.4)	5,528 (15.7)		40 (19.4)	41 (19.9)			
	Isolated	30 (14.6)	2,381 (6.8)		30 (14.6)	25 (12.1)			
Mother Smoking During Pregnancy	Yes	28 (13.6)	5,581 (15.9)	0.67	28 (13.6)	22 (10.7)	0.06	-	0.66
	No	113 (54.9)	18,871 (53.6)		113 (54.9)	118 (57.3)			
	Unknown	65 (31.6)	10,740 (30.5)		65 (31.6)	66 (32.0)			
Mother Married at Birth	Yes	24 (11.7)	10,831 (30.8)	<0.001	24 (11.7)	23 (11.2)	0	-	0.99
	No	119 (57.8)	13,979 (39.7)		119 (57.8)	120 (58.3)			
	Unknown	63 (30.6)	10,382 (29.5)		63 (30.6)	63 (30.6)			
Had Father Birth Date	Yes	105 (51.0)	25,109 (71.3)	<0.001	105 (51.0)	107 (51.9)	-0.01	1	0.84
	No	101 (49.0)	10,083 (28.7)		101 (49.0)	99 (48.1)			
Mother Age Category	Less Than 20	112 (54.4)	3,971 (11.3)	<0.001	112 (54.4)	113 (54.9)	0.14	-	0.80
	20 To 35	91 (44.2)	28,425 (80.8)		91 (44.2)	91 (44.2)			
	35-40	2 (1.0)	2,361 (6.7)		2 (1.0)	2 (1.0)			
	40 And Above	1 (0.5)	435 (1.2)		1 (0.5)	-			
Mother WIC Receipt at Birth	Yes	177 (85.9)	20,642 (58.7)	<0.001	177 (85.9)	181 (87.9)	0.09	-	0.67
	No	25 (12.1)	13,942 (39.6)		25 (12.1)	23 (11.2)			
	Unknown	4 (1.9)	608 (1.7)		4 (1.9)	2 (1.0)			

		Unmatched (N=35,398)			PS Matched (N=412)				
		Treatment (N=206)	Control (N=35,192)		Treatment (N=206)	Control (N=206)			
Variables	Unit	Mean (SE) / N (%)	Mean (SE) / N (%)	P*	Mean (SE) / N (%)	Mean (SE) / N (%)	SD	VR	P
Mother Hospital Length at Birth	< 5 Days	203 (98.5)	34,342 (97.6)	0.95	203 (98.5)	204 (99.0)	-0.04	-	0.65
	5-< 10 Days	3 (1.5)	712 (2.0)		3 (1.5)	2 (1.0)			
	10 -< 21 Days	-	58 (0.2)		-	-			
	21 -< 47 Days	-	43 (0.1)		-	-			
	47 =< 94 Days	-	29 (0.1)		-	-			
	> 94 Days	-	8 (0.0)		-	-			
Notes: P value based on chi-square for categorical variables. Abbreviations: HS=High School; RUCA=rural-urban commuting area code; SE=standard error; PS=propensity score; Std Diff=standardized difference; VR=variance ratio									

Appendix C. Health Care Utilization and Child Outcomes by Child Age

Table C-1. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Infant Birth Outcomes and Breastfeeding Intention

	Treatment (N=209)	Control (N=209)	EstDiff/aOR (95% CI)^a	P Value
<i>Continuous Outcomes</i>				
Gestational Age (Mean, SE)	38.9 (0.08)	38.1 (0.16)	0.80 (0.44-1.15)	<0.001
Birth Weight (Mean, SE)	3282 (31.1)	3139 (38.7)	143 (45.4-240)	0.004
<i>Binary Outcomes</i>				
Preterm Birth (n, %) ^b	4.00 (1.91)	28.0 (13.4)	0.13 (0.04-0.37)	<0.001
Low Birth Weight (n, %) ^c	10.0 (4.78)	20.0 (9.57)	0.47 (0.22-1.04)	0.06
Maternal Intention to Breastfeed (n, %) ^d	110 (74.8)	87.0 (59.2)	2.05 (1.24-3.38)	0.005
^a Estimated differences for continuous variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. ^b Preterm birth defined as before 37 weeks gestation. ^c Low Birth Weight defined as <2500 grams. ^d N=147. Abbreviations: IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-2. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Child Health Care Outcomes From Birth to Age 1

	Treatment (N=601)	Control (N=601)	aOR/IRR (95% CI) ^a	P Value
<i>Immunizations</i>				
Immunization visits (mean, SE)	4.91 (0.08)	4.28 (0.08)	1.15 (1.09-1.21)	<0.001
≥ 4 immunization visits (proportion, SE)	469 (78.0)	413 (68.7)	1.62 (1.25-2.10)	<0.001
<i>Health Care and Early Intervention Continuous Outcomes</i>				
Inpatient stays (mean, SE)	0.23 (0.02)	0.17 (0.02)	1.36 (1.02-1.82)	0.04
ED visits (mean, SE)	1.48 (0.07)	1.27 (0.07)	1.16 (1.01-1.34)	0.04
Non-urgent ED visits (mean, SE)	1.00 (0.05)	0.83 (0.05)	1.20 (1.03-1.40)	0.02
Outpatient visits	13.0 (0.55)	10.7 (0.33)	1.22 (1.12-1.31)	<0.001
Wellness visits (mean, SE)	4.26 (0.07)	3.88 (0.07)	1.10 (1.04-1.16)	0.001
Non-wellness/non-SLP visits (mean, SE)	7.65 (0.26)	6.81 (0.22)	1.12 (1.02-1.24)	0.02
Early intervention/SLP visits (mean, SE)	0.66 (0.21)	0.28 (0.09)	2.33 (1.01-5.39)	0.05
Prescription medications (filled; mean, SE)	6.56 (0.30)	5.74 (0.27)	1.14 (1.01-1.30)	0.04
<i>Health Care Utilization Binary Outcomes</i>				
At least one inpatient stays (n, %)	114 (19.0)	82.0 (13.6)	1.48 (1.09-2.02)	0.01
At least one ED visit (n, %)	379 (63.1)	337 (56.1)	1.34 (1.06-1.69)	0.01
At least one non-urgent ED visit (n, %)	316 (52.6)	281 (46.8)	1.26 (1.01-1.58)	0.04
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; SLP = speech-language pathology; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-3. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Child Health Care Outcomes From Age 1 to 2

	Treatment (N=482)	Control (N=482)	aOR/IRR (95% CI) ^a	P Value
<i>Immunizations</i>				
Immunization visits (mean, SE)	2.87 (0.07)	2.53 (0.06)	1.13 (1.05-1.23)	0.001
<i>Health Care and Early Intervention Continuous Outcomes</i>				
Inpatient stays (mean, SE)	0.05 (0.02)	0.08 (0.03)	0.68 (0.26-1.74)	0.42
ED visits (mean, SE)	1.33 (0.07)	1.01 (0.06)	1.32 (1.13-1.54)	<0.001
Non-urgent ED visits (mean, SE)	0.94 (0.06)	0.70 (0.05)	1.35 (1.13-1.62)	<0.001
Outpatient visits	13.1 (1.02)	10.3 (0.75)	1.22 (1.07-1.40)	0.004
Wellness visits (mean, SE)	1.78 (0.05)	1.65 (0.05)	1.08 (0.98-1.19)	0.12
Non-wellness/non-SLP visits (mean, SE)	5.57 (0.26)	5.42 (0.22)	1.02 (0.91-1.15)	0.74
Early intervention/SLP visits (mean, SE)	2.37 (0.57)	1.54 (0.44)	1.54 (0.68-3.50)	0.30
Prescription medications (filled; mean, SE)	7.05 (0.43)	6.50 (0.34)	1.08 (0.94-1.25)	0.26
<i>Health Care Utilization Binary Outcomes</i>				
At least one inpatient stays (n, %)	14.0 (2.90)	16.0 (3.32)	0.87 (0.42-1.81)	0.71
At least one ED visit (n, %)	305 (63.3)	253 (52.5)	1.56 (1.21-2.02)	<0.001
At least one non-urgent ED visit (n, %)	245 (50.8)	207 (42.9)	1.37 (1.07-1.77)	0.01
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; SLP = speech-language pathology; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-4. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Child Health Care Outcomes From Age 2 to 3

	Treatment (N=391)	Control (N=391)	aOR/IRR (95% CI) ^a	P Value
<i>Immunizations</i>				
Immunization visits (mean, SE)	1.23 (0.05)	0.99 (0.04)	1.24 (1.09-1.42)	0.002
<i>Health Care and Early Intervention Continuous Outcomes</i>				
Inpatient stays (mean, SE)	0.02 (0.01)	0.05 (0.02)	0.50 (0.16-1.60)	0.24
ED visits (mean, SE)	0.91 (0.06)	0.79 (0.06)	1.15 (0.93-1.41)	0.20
Non-urgent ED visits (mean, SE)	0.62 (0.05)	0.52 (0.05)	1.19 (0.93-1.51)	0.17
Outpatient visits	17.4 (1.92)	13.9 (1.63)	1.21 (0.98-1.50)	0.07
Wellness visits (mean, SE)	0.76 (0.03)	0.63 (0.03)	1.22 (1.03-1.44)	0.02
Non-wellness/non-SLP visits (mean, SE)	4.34 (0.33)	3.76 (0.26)	1.15 (0.97-1.37)	0.10
Early intervention/SLP visits (mean, SE)	4.79 (1.17)	3.95 (1.01)	1.21 (0.49-2.98)	0.68
Prescription medications (filled; mean, SE)	6.09 (0.39)	5.33 (0.33)	1.14 (0.96-1.36)	0.13
<i>Health Care Utilization Binary Outcomes</i>				
At least one inpatient stays (n, %)	7.00 (1.79)	10.0 (2.56)	0.69 (0.26-1.85)	0.46
At least one ED visit (n, %)	197 (50.4)	164 (41.9)	1.41 (1.06-1.86)	0.02
At least one non-urgent ED visit (n, %)	154 (39.4)	119 (30.4)	1.49 (1.10-2.00)	0.01
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; SLP = speech-language pathology; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-5. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Maternal Health Care Outcomes From Birth to Child’s Age 1

	Treatment (N=269)	Control (N=269)	aOR/IRR (95% CI) ^a	P Value
<i>Health Care Outcomes: Continuous</i>				
Inpatient stays (mean, SE)	0.17 (0.03)	0.15 (0.03)	1.11 (0.68-1.81)	0.67
ED visits (mean, SE)	1.33 (0.12)	0.90 (0.08)	1.48 (1.16-1.89)	0.002
Non-urgent ED visits (mean, SE)	0.67 (0.07)	0.45 (0.05)	1.47 (1.09-1.98)	0.01
Outpatient visits	8.52 (0.57)	5.45 (0.43)	1.56 (1.30-1.88)	<0.001
Wellness visits (mean, SE)	0.16 (0.03)	0.13 (0.03)	1.26 (0.78-2.02)	0.34
Non-wellness visits (mean, SE)	7.52 (0.53)	4.91 (0.41)	1.53 (1.26-1.85)	<0.001
Mood disorder visits (mean, SE)	4.46 (0.70)	2.13 (0.42)	2.09 (1.16-3.76)	0.01
Substance-related disorder visits (mean, SE)	4.05 (1.03)	1.76 (0.34)	2.21 (1.05-4.65)	0.04
Prescription medications (filled; mean, SE)	10.6 (0.64)	9.19 (0.59)	1.16 (0.97-1.37)	0.10
<i>Health Care Outcomes: Binary</i>				
At least one ED visit (n, %)	152 (56.5)	122 (45.4)	1.57 (1.11-2.20)	0.01
At least one non-urgent ED visit (n, %)	104 (38.7)	82.0 (30.5)	1.44 (1.00-2.06)	0.05
At least one mood disorder visit (n, %)	85.0 (31.6)	55.0 (20.4)	1.80 (1.21-2.66)	0.004
At least one substance-related disorder visit (n, %)	54.0 (20.1)	43.0 (16.0)	1.32 (0.85-2.07)	0.22
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-6. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Maternal Health Care Outcomes From Child’s Age 1 to 2

	Treatment (N=260)	Control (N=260)	aOR/IRR (95% CI) ^a	P Value
<i>Health Care Outcomes: Continuous</i>				
Inpatient stays (mean, SE)	0.38 (0.05)	0.36 (0.04)	1.05 (0.76-1.46)	0.75
ED visits (mean, SE)	1.38 (0.12)	1.23 (0.12)	1.13 (0.87-1.46)	0.35
Non-urgent ED visits (mean, SE)	0.68 (0.07)	0.59 (0.08)	1.16 (0.83-1.61)	0.39
Outpatient visits	8.95 (0.77)	7.42 (0.50)	1.21 (1.00-1.45)	0.05
Wellness visits (mean, SE)	0.20 (0.03)	0.20 (0.04)	0.98 (0.63-1.54)	0.94
Non-wellness visits (mean, SE)	7.77 (0.73)	6.48 (0.45)	1.20 (0.99-1.45)	0.06
Mood disorder visits (mean, SE)	5.55 (1.58)	2.62 (0.48)	2.12 (1.11-4.02)	0.02
Substance-related disorder visits (mean, SE)	4.32 (1.12)	3.27 (0.62)	1.32 (0.66-2.64)	0.43
Prescription medications (filled; mean, SE)	10.6 (0.75)	9.20 (0.71)	1.15 (0.94-1.40)	0.18
<i>Health Care Outcomes: Binary</i>				
At least one ED visit (n, %)	141 (54.2)	131 (50.4)	1.17 (0.83-1.65)	0.38
At least one non-urgent ED visit (n, %)	93.0 (35.8)	79.0 (30.4)	1.28 (0.88-1.84)	0.19
At least one mood disorder visit (n, %)	70.0 (26.9)	61.0 (23.5)	1.20 (0.81-1.79)	0.36
At least one substance-related disorder visit (n, %)	56.0 (21.5)	61.0 (23.5)	0.90 (0.59-1.35)	0.60
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Table C-7. Healthy Families America Treatment and Control Group Health Care Utilization and Outcome Measures Differences — Maternal Health Care Outcomes From Child’s Age 2 to 3

	Treatment (N=206)	Control (N=206)	aOR/IRR (95% CI) ^a	P Value
<i>Health Care Outcomes: Continuous</i>				
Inpatient stays (mean, SE)	0.45 (0.08)	0.42 (0.06)	1.09 (0.69-1.71)	0.71
ED visits (mean, SE)	1.37 (0.13)	1.23 (0.15)	1.11 (0.84-1.46)	0.46
Non-urgent ED visits (mean, SE)	0.58 (0.07)	0.53 (0.08)	1.08 (0.75-1.55)	0.67
Outpatient visits	9.71 (0.72)	6.99 (0.55)	1.39 (1.14-1.70)	0.001
Wellness visits (mean, SE)	0.22 (0.04)	0.21 (0.03)	1.08 (0.68-1.72)	0.73
Non-wellness visits (mean, SE)	8.45 (0.67)	6.41 (0.52)	1.32 (1.07-1.62)	0.009
Mood disorder visits (mean, SE)	4.82 (1.17)	2.90 (0.72)	1.66 (0.82-3.37)	0.16
Substance-related disorder visits (mean, SE)	3.66 (0.68)	3.84 (0.99)	0.95 (0.44-2.07)	0.90
Prescription medications (filled; mean, SE)	11.3 (1.00)	8.64 (0.77)	1.31 (1.02-1.68)	0.03
<i>Health Care Outcomes: Binary</i>				
At least one ED visit (n, %)	118 (57.3)	106 (51.5)	1.27 (0.86-1.87)	0.24
At least one non-urgent ED visit (n, %)	74.0 (35.9)	61.0 (29.6)	1.33 (0.88-2.02)	0.17
At least one mood disorder visit (n, %)	63.0 (30.6)	43.0 (20.9)	1.67 (1.07-2.62)	0.03
At least one substance-related disorder visit (n, %)	50.0 (24.3)	42.0 (20.4)	1.25 (0.78-2.00)	0.35
^a Incidence rate ratio for counting variables and adjusted odds ratio for binary variables are calculated by generalized linear model with the matched ID as a random effect. Abbreviations: ED = emergency department; IRR=incidence rate ratio; aOR= adjusted odds ratio; SE=standard error; CI=confidence interval.				

Appendix D. Claims Codes Used in Variable Definitions

Variable	Codes
<i>Child Health Care and Early Intervention Utilization Outcomes</i>	
Hospitalizations ¹	UBREV: 100, 101, 110, 111-114, 116-124, 126-134, 136-144, 146-154, 156-160, 164, 167, 169-174, 179, 190-194, 199-204, 206-214, 219, 1000-1002
Emergency department visits ¹	CPT: 99281-99285 / UBREV: 450-452, 456, 459, 981 Non-urgent: CPT: 99281–99283
Wellness visits ²	CPT: 99381-99385, 99391-99395, 99432, 99461 / HCPCS: G0438, G0439 / ICD-9: V20.2, V20.31, V20.32, V70.0, V70.3, V70.5, V70.6, V70.8, V70.9 / ICD-10: Z00.00, Z00.01, Z00.110, Z00.111, Z00.121, Z00.129, Z00.5, Z00.8, Z02.0-Z02.6, Z02.71, Z02.79, Z02.81-Z02.83, Z02.89, Z02.9
Outpatient non-wellness visits ^{1,3}	POS: 3, 5, 7, 9, 11-20, 22, 33, 49, 50, 71, 72
Early intervention – speech-language pathology visits	CPT: 31579, 70371, 74230, 90901, 92507, 92508, 92511, 92520-92524, 92526, 92597, 92605-92618, 92626, 92627, 92630, 92633, 96105, 96110, 96112, 96125, 97032, 97110, 97112, 97129, 97130, 97530, 97533, 97535, 97537, 96113 / HCPCS: G0451, G0515
<i>Maternal Health Care Utilization Outcomes</i>	
Mood disorder visits ⁴	ICD-9 or ICD-10: CCS Category 657
Substance-related disorder visits	ICD-9 or ICD-10: CCS Category 661

Notes: 1=HEDIS 2019 definition; 2=HEDIS 2016 definition; 3=Excludes wellness and early intervention visit codes; 4=Clinical Classifications Software.^{46,47}

Acknowledgements

Healthy Families America is an evidence-based intervention funded and supported by the Arkansas Home Visiting Network. Funding for HFA services and this study was made possible by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under grant number X10MC39673 of the Affordable Care Act - Maternal, Infant, and Early Childhood Home Visiting Program awarded to the Arkansas Department of Health.

The Arkansas Center for Health Improvement (ACHI) is a health policy organization that maintains and administers the Health Data Initiative and the Arkansas Transparency Initiative (ATI) data warehouses. Contained within the ATI data warehouses are the Arkansas All-Payer Claims Database (APCD) and Arkansas Department of Health (ADH) Vital Records. Access to the APCD for this study was provided by support from the Arkansas Biosciences Institute/Arkansas Insurance Department/ACHI Collaboration.

Faculty and staff of the UAMS Department of Family and Preventive Medicine (DFPM) and ACHI carried out the major components of the evaluation. The information, content, or conclusions expressed in this material are those of the author(s) and should not be construed as the official position or policy of, nor should any endorsements be inferred by, HRSA, HHS, or the U.S. Government.

