Short-Term Medicaid Utilization Associated With an Advanced Primary Care Model

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abstract

OBJECTIVE: Early childhood advanced primary care models are promising ways of addressing child and family needs, but there is limited evidence to support short-term sustainability within current Medicaid payment structures. We evaluate claims-based outcomes associated with 3-2-1 IMPACT (IMPACT), an early childhood advanced primary care model, compared with the standard of care.

METHODS: Using New York State Medicaid claims, we identified and matched children aged 1 to 35 months receiving care at 3 IMPACT sites and 3 comparison sites within a large public hospital system. Regression models were used to analyze use, expenditure, enrollment, and quality outcomes between groups.

RESULTS: There were 6045 children at the treatment sites and 4832 matched children from the comparison sites. IMPACT was associated with a significant increase in 6 or more well-child visits and a decrease in emergency department visit rates. There was also a significant increase in 6 more well-child visits specifically for Black and Hispanic children seeking care at IMPACT sites compared with comparison sites. There were no significant differences in expenditures, other use types, or Medicaid enrollment across groups.

CONCLUSION: An early childhood advanced primary care model that incorporates multiple evidence-based programs can show short-term, positive effects on preventative and acute care use and quality within Medicaid. These results highlight short-term strategies for sustainability while awaiting the long-term, cross-sector benefits expected from models like IMPACT. Future studies addressing additive model component effects and longer-term outcomes across mother-child dyadic and social-emotional outcomes are warranted.

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Dr Piwnica-Worms conceptualized and designed the study, drafted the initial manuscript, and critically reviewed and revised the manuscript. Dr Howland designed the study and data collection instruments, collected data, carried out the initial analyses, drafted the initial manuscript, and critically reviewed and revised the manuscript. Dr McCord conceptualized and designed the study and critically reviewed and revised the manuscript. Dr Fierman and Ms Charney interpreted the data and critically reviewed and revised the manuscript for important intellectual content. Mr Billings coordinated and supervised data collection and critically reviewed and revised the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

WHAT'S KNOWN ON THIS SUBJECT: Early childhood advanced primary care models are promising ways of addressing child and family needs, but there is limited evidence to support short-term sustainability within current Medicaid payment structure constraints.

WHAT THIS STUDY ADDS: We show the positive, short-term effects of an early childhood advanced primary care model (3-2-1 IMPACT) within a large public hospital system on acute and preventative health care use and quality within Medicaid, both overall and for minoritized populations.

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INTRODUCTION

Supporting relational health is a key goal of early childhood advanced primary care models and requires greater integration across women's health, pediatrics, and behavioral health.[1–4] Evidence-based models often focus on screenings, preventative and integrated mental health, health-related social needs, parent support and coaching, and early learning and literacy.[5–7] These models address the full range of child and family needs, with a focus on social-emotional well-being and prevention of health disparities in early childhood.

One such model is the 3-2-1 IMPACT (IMPACT) program, a population-based team approach to providing enhanced services to children aged 0 to 3 years and their caregivers. This program was developed and piloted at 3 primary care sites within the largest public hospital system in the United States (New York City Health + Hospitals [H+H]).[8] Based on New York State's (NYS's) First 1000 Days on Medicaid advanced pediatric primary care model,[9] IMPACT integrates several programmatic components in a population-health model serving all children aged 0 to 5 years in the practice. This includes 3 evidence-based early-learning and parenting support programs (HealthySteps,[10] PlayReadVIP,[11] Reach Out and Read[12]), integrated behavioral health providers across pediatrics and women's health,[13] early childhood-trained community health workers,[14] and universal early childhood screenings (across development, social determinants of health, postpartum depression, and social-emotional well-being), with clinical risk tiering and timely access to enhanced services for families with identified need.[9]

Despite evidence of long-term and cross-sector returns on investment,[15–18] models like IMPACT have struggled with proving short-term savings and largely rely on grants or health system support.[3,8,19] More research is needed to determine whether models like IMPACT drive improvements in short-term outcomes, including health care use, expenditures, and quality, particularly among children publicly insured and from minoritized populations. This is especially salient for public hospital systems like H+H, in which more than 80% of children in pediatric primary care are insured through Medicaid and more than 75% identify as Black or Hispanic in the electronic medical record.

Our primary objective was to evaluate the 12-month use, expenditure, enrollment, and quality outcomes associated with IMPACT. To assess the potential impact for populations at higher risk of health inequities, we also evaluated outcomes specifically for Black and Hispanic children.

METHODS

Data

We used NYS Medicaid data, which include fee-for-service claims and managed-care encounters for all members enrolled in Medicaid in the state. These data are collected by the NYS Department of Health and provided to the Health Evaluation and Analytics Lab at New York University under a data use agreement. This project was approved by the state and received an institutional review board exemption from the Biomedical Research Alliance of New York.

Study Design and Participants

Using NYS Medicaid claims, we created a cohort study comparing children aged 1 to 35 months who had a well-child visit at an IMPACT site (the "treatment") with children at 3 comparison sites within H+H (Supplemental Table 1). Children were attributed to a site based on the location of their first visit between October 1, 2020, and June 30, 2022 (the first 21 months of the program). Comparison sites were those that did not have access to IMPACT but had similar patient demographics and insurance status, practice size, and federally qualified health center designation. The initial sample included 6368 children (54%) at the IMPACT sites and 5424 children (46%) at the comparison sites. Children were linked with mothers if the child and mother had matching NYS Medicaid case numbers and the child's birth date fell within 30 days of the mother's hospital admission delivery date or if the child and mother's last name matched.[20]

Matching

We used matching methods to reduce potential differences between children at the treatment and comparison sites. We selected children from comparison sites using Mahalanobis distance matching, which pairs individuals that have the smallest distance between individual covariate values.[21] Exact matching was done on paired sites, race and ethnicity, age group, and whether the child had a linked mother on Medicaid. Other matching variables included demographic and clinical characteristics of the child and the mother (Supplemental Table 2). Matches were selected using nearest neighbor methods (1:5) with replacement. Additional entropy balance weights were estimated using the same set of variables, such that the sample achieved balance across all covariates.[21]

To improve the completeness of self-reported race and ethnicity in Medicaid, we imputed race and ethnicity for people missing values using the Bayesian Improved Surname Geocoding method,[22] bringing the proportion of missing values from 20.3% to 0.20% (Supplemental Table 3). Although we acknowledge race and ethnicity as social constructs, they were included as variables in our analyses as racism-driven disparities are increasingly recognized as significant contributors to poor long-term health outcomes and are potential targets for primary care interventions, such as IMPACT.[4,5,8]

There were 6045 children in the final treatment group, and 4832 children selected as comparisons. Only 323 children in the treatment group (5.1% of original sample) could not be matched and were not included in the final analysis (Supplemental Table 4). The unmatched group was demographically similar to the matched group; however, roughly half (43.02%) of the unmatched children were Asian or Pacific Islanders, reflecting the racial and ethnic differences between sites. A larger proportion of the unmatched children were preterm (32.2%) than the matched sample, meaning it may have been harder to find matches for some of the sickest children.

Measures

The primary outcomes of interest were health care use (inpatient, emergency, primary care, dental care) and expenditures in the first 12 months following the initial well-child visit. We also looked at early intervention evaluation and services and lead screening (Supplemental Table 5). In order to look at the Healthcare Effectiveness Data and Information Set (HEDIS) definition of adequate (6+) well-child visits by 15 months,[23] we took a subgroup of children with continuous Medicaid enrollment born after January 1, 2020, and who turned 15 months during the study period and counted the total well-child visits from birth to 15 months. Finally, we estimated the impacts on Medicaid enrollment, both as the number of months, and the proportion of children with continuous enrollment.

Statistical Analysis

We provide descriptive characteristics of the sample at the treatment and comparison sites before and after matching. We also present the standardized mean differences (SMD) to quantify how groups differed for a given variable. Traditionally, any differences greater than 10% are considered meaningfully different.

The effect of the IMPACT program was estimated using regression models with attribution to an IMPACT site as the main exposure. To capture the effect among people "engaged" in the program, we further examined models among children with 3 or more well-child visits at the same site within 12 months for children aged 1 to 24 months and 2 or more visits for children aged 25 months or older. We stratified our results for children identified as Black or Hispanic, who account for more than 75% of the young children seeking primary care at H+H and face substantial physical, mental, and behavioral-health inequities.[4,5,24,25]

The models were weighted using entropy balance weights and included robust standard errors.[21] Linear probability models were used for binary measures of any use and negative binomial models were run for counts, with an offset term for the number of months enrolled during the same period. Annualized expenditures were modeled using a gamma distribution and log linked to account for the skewed nature of the distribution. To mitigate the potential influence of outliers, we also reran estimates replacing the top 1% of expenditures with the 99th percentile value (winsorized).[26]

To understand the potential effect of the matching process and excluding some children from the treatment group, we ran a traditional regression-adjusted model with everyone in the full sample (including the individuals who were dropped from the matched analysis) and then adjusted for all the same variables that were included in the match (Supplemental Table 2).

To address concerns of unmeasured confounding between sites, we used a cross-sectional, difference-in-differences (DiD) approach to compare outcomes before and after the start of the program and between the treatment and comparison sites. We selected a new group of children attributed to the treatment (n = 6101) and comparison sites (n = 5205) in the 21-month period prior to the start of IMPACT (January 1, 2019–September 30, 2020) based on the first well-child visit in the period. We combined this baseline sample with the full, unmatched posttreatment sample from the main analysis (the 21-month period from October 1, 2020, to June 30, 2022) and ran regression models for the outcomes with a measure of time (before and after the start of IMPACT) and treatment (0,1) and an interaction between the two variables, which is the DiD estimator. To account for potential changes in the composition of the samples over time that could also affect the trend in the outcomes, we ran models with and without all demographic and use variables used in the matching process from the main analysis. Given that outcomes were estimated over a longer time horizon than the main models (21 months total [DiD)] vs 12 months after the first well-child visit [main analysis]), we further adjusted for months of Medicaid enrollment and days in treatment and control groups based on the first well-child visit in the 21-month pre- or post-periods.

All linkage and data manipulation were conducted in SAS version 9.4 (SAS Institute Inc). Matching, weighting, and subsequent regression models were conducted in STATA 16 (StataCorp LLC).

RESULTS

Characteristics of Children at IMPACT Sites and Comparison Sites

Table 1 shows the characteristics of children in the IMPACT group and their linked mothers compared with children at the comparison sites before and after matching and weighting the sample. Before matching, differences existed by group for child's race and ethnicity, prematurity, and medical complexity. After matching, the SMDs were all zero, meaning the groups were balanced across all the measured characteristics. Balance was also achieved for all the subgroups presented.

TABLE 1. Characteristics of Children and Linked Mothers at IMPACT and Comparison Sites Before and After Matching and Weighting

	Prematched			Postmatched		
	IMPACT Group (n = 6368)	Comparison Group (n = 5424)	SMD (%)	IMPACT Group (n = 6045)	Comparison Group (n = 4832)	SMD (%)
Child						
Race and ethnicity (self-reported and predicted), %						
Black	24.2	24.3	−0.2	25.1	25.1	0.0
Hispanic	45.8	62.9	−34.4	46.8	46.8	0.0
Asian Pacific Islander	16.6	3.8	41.5	15.2	15.2	0.0
Other	13.4	9.0	13.9	12.9	12.9	0.0
Age group at first well-child visit, months, %						
1–6	57.9	53.3	9.3	58.6	58.6	0.0
7–12	10.6	11.9	−4.2	10.5	10.5	0.0
13–24	18.2	19.7	−3.8	18.2	18.2	0.0
25–35	13.3	15.1	−5.2	12.8	12.8	0.0
Quarter of first well-child visit, %						
1 (January-March)	26.0	27.9	−4.1	26.0	26.0	0.0
2 (April-June)	18.3	19.8	−1.5	18.5	18.5	0.0
3 (July-September)	9.5	9.2	0.3	9.3	9.3	0.0
4 (October-December)	46.2	43.1	3.0	46.1	46.1	0.0
Facility pair (IMPACT-comparison site), %						
1	45.2	40.9	8.7	44.5	44.5	0.0
2	41.2	38.2	6.0	42.0	42.0	0.0
3	13.6	20.9	−19.4	13.5	13.5	0.0
Female, %	48.7	48.8	−0.1	48.9	48.9	0.0
Premature birth[a], %	13.3	7.5	18.8	12.3	12.3	0.0
Child medical complexity[b], %	16.6	12.6	11.2	16.4	16.4	0.0
12-month Medicaid enrollment, mean	8.4	8.4	0.0	8.37	8.37	0.0
Total Medicaid enrollment months (birth to enrollment), mean	10.2	11.0	−7.4	10.15	10.15	0.0
Mother						
Linked mother in Medicaid claims, %	87.9	86.1	5.4	88.6	88.6	0.0
Age at child's first well-child visit, years, %						
<20	2.2	3.1	−5.5	2.1	2.1	0.0
20–29	38.4	40.4	−4.1	39.4	39.4	0.0
30–39	40.2	36.6	7.5	40.3	40.3	0.0
≥40	7.1	6.0	4.3	6.9	6.9	0.0
Clinical characteristics, %						
High ED use[c]	23.0	23.8	−1.9	23.3	23.3	0.0
Chronic condition[d]	20.9	20.8	0.2	20.8	20.8	0.0
Substance use disorder[e]	5.8	8.3	−9.8	5.6	5.6	0.0
Serious mental health condition[f]	17.3	18.6	−3.6	17.2	17.2	0.0
Dual Medicare/Medicaid eligibility, %	0.3	0.3	−0.1	0.0	0.0	0.0

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Child Outcomes Associated With IMPACT

Results of the evaluation are shown in Table 2 for the first 21 months of IMPACT. Care at IMPACT sites was associated with a 12% decrease in the emergency department (ED) visit rate per Medicaid months enrolled (0.97 visits vs 1.1 visits, $P = .03$). Among the subset of children who were aged 15 months or more by June 30, 2023, we found that IMPACT was associated with a 7.8 percentage point increase in the

TABLE 1. Characteristics of Children and Linked Mothers at IMPACT and Comparison Sites Before and After Matching and Weighting (Continued)

	Prematched			Postmatched		
	IMPACT Group (n = 6368)	Comparison Group (n = 5424)	SMD (%)	IMPACT Group (n = 6045)	Comparison Group (n = 4832)	SMD (%)
Moved 2+ times in year prior, %	4.5	4.1	2.0	4.3	4.3	0.0
Total Medicaid enrollment months in prior 6 months, mean	4.7	4.7	−2.8	4.7	4.7	0.0

Abbreviations: ED, emergency department; *ICD-10, International Statistical Classification of Diseases, Tenth Revision*; IMPACT, 3-2-1 IMPACT; MDD, major depressive disorder; SMD, standardized mean difference.

SMD is a statistical measure that quantifies the difference between 2 groups. The SMD is calculated as the difference in the mean between the treatment and comparison group divided by the pooled SD of the variable (thereby making it unitless). An SMD of 0 means there is no difference between groups, and we used a threshold of 0.1 or 10% as indicating a meaningful difference

[a] Premature birth = any diagnosis with *ICD-10* codes P07.2 or P07.3.

[b] Child medical complexity = up to 3 years of historical diagnoses and procedures, any code from the pediatric complex chronic conditions classification system version 2.[27]

[c] Mother high ED use = 2+ ED visits in 12 months prior.

[d] Mother chronic condition = includes any chronic condition included in Charlson Comorbidity Index from up to 3 years prior.

[e] Mother substance use disorder = includes a combination of diagnoses for substance-related disorders from up to 3 years prior; these codes are captured in the Clinical Classification Code 661.

[f] Mother serious mental health condition = including a combination of diagnoses codes for schizophrenia, mood disorders (eg, bipolar, MDD), suicide, and intentional self-inflicted injury.

TABLE 2. Health Care Use and Quality Measures Among Medicaid-Insured Children at IMPACT and Comparison Sites (N = 10 877)

Outcome Measures	Mean IMPACT (n = 6045)	Mean Comparison (n = 4832)	Difference	*P* Value
Any use, %[a]				
ED visit	44.5	46.5	−2.0	.19
Hospitalization	5.7	6.8	−1.1	.18
Primary care visit	89.1	90.2	−1.2	.20
Well-child visit	88.8	89.6	−0.8	.30
Specialist visit	36.4	34.0	2.4	.11
Dental visit (preventative)	17.4	12.1	5.2	<.001***
Early intervention services	6.0	5.1	0.8	.16
Early intervention evaluation	6.6	5.9	0.7	.21
Lead screening	63.1	63.1	0.0	.98
Annualized Medicaid expenditures, $[b]	3999	4130	−131	.84
Winsorized Medicaid expenditures (1%), $[c]	2840	3107	−267	.28
Use rates (per Medicaid months enrolled)[d]				
ED visit	0.97	1.10	−0.13	.03
Hospitalization	0.08	0.08	−0.01	.67
Specialist visit	1.07	0.90	0.17	.02*
Primary care visit	3.94	3.86	0.09	.45
Well-child visit	2.62	2.55	0.07	.15
Dental visit (preventative)	0.62	0.46	0.16	<.001***
Continuous Medicaid enrollment, %	94.1	93.4	0.67	.26
Medicaid enrollment, months	11.55	11.48	0.07	.16
Quality, %[e]				
6+ well-child visits by 15 months	65.8	58.0	7.8	<.001***

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TABLE 2. Health Care Use and Quality Measures Among Medicaid-Insured Children at IMPACT and Comparison Sites (N = 10 877) (Continued)

Abbreviations: ED, emergency department; IMPACT, 3-2-1 IMPACT.

*$P < .05$; **$P < .01$; ***$P < .001$

[a] Linear probability model with robust standard errors.

[b] Gamma distribution, log link.

[c] Winsorized expenditures replace the top 1% of expenditures with the 99th percentile value to reduce the impact of outliers.

[d] Negative binomial with an offset for the number of months enrolled.

[e] Includes children with continuous Medicaid enrollment born after January 1, 2020, and who turned 15 months during the study period (n = 6210).

proportion of children who had 6 or more well-child visits (65.8% vs 58.0%, $P < .001$). We also found a 19% increase in specialist visits (1.07 vs 0.90 visits, $P = .02$). IMPACT was also associated with a 35% increase in the preventative dental visit rate (0.62 vs 0.46 visits, $P < .001$). There were no significant differences in other primary care measures, early intervention, inpatient use, or expenditures (both overall and winsorized estimates) although both inpatient visits and expenditures were lower for children enrolled in IMPACT vs comparison sites.

Results were stronger among the roughly 77.5% of children who were "engaged" in primary care at the IMPACT sites vs "engaged" in primary care at the comparison sites (Table 3). Within this group, there was both a significant decrease in ED visit rates and a 3.4 percentage point decline

TABLE 3. Health Care Use and Quality Measures Among Medicaid-Insured Children at IMPACT and Comparison Sites That Were Engaged in Primary Care (n = 8436)

	Engaged in Care[a] −455−455			
	Mean IMPACT	Mean Comparison	Difference	*P* Value
Any use, %[b]				
ED visit	47.0	50.4	−3.4	.05
Hospitalization	5.9	7.7	−1.9	.07
Primary care visit	98.3	98.4	0.0	.98
Specialist visit	37.8	36.0	1.8	.29
Dental visit (preventative)	17.6	11.7	5.9	<.001***
Early intervention services	5.8	5.1	0.7	.30
Early intervention evaluation	6.8	6.1	0.7	.28
Lead screening	68.1	67.8	0.3	.86
Annualized Medicaid expenditures, $[c]	3898	4553	−655	.40
Winsorized Medicaid expenditures (1%), $[d]	2898	3353	−455−455	.12
Use rates (per Medicaid months enrolled)[e]				
ED visit	1.0	1.2	−0.18	.01*
Hospitalization	0.08	0.095	−0.01	.36
Specialist	1.12	0.96	0.15	.09
Primary care visit	4.21	4.10	0.11	.29
Dental visit (preventative)	0.61	0.43	0.18	<.001***
Continuous Medicaid enrollment, %	96.1	95.6	0.47	.37
Medicaid enrollment, months	11.74	11.68	0.06	.08
Quality, %[f]				
6+ well-child visits by 15 months	70.7	61.1	9.6	<.001***

Abbreviations: ED, emergency department; IMPACT, 3-2-1 IMPACT.
*$P < .05$; **$P < .01$; ***$P < .001$
[a] Engaged is defined as 3+ well-child visits over a 12-month period for children aged 0–2 years and 2+ well-child visits over a 12-month period for children aged 2 years or older.
[b] Linear probability model with robust standard errors.
[c] Gamma distribution, log link.
[d] Winsorized expenditures replace the top 1% of expenditures with the 99th percentile value to reduce the impact of outliers.
[e] Negative binomial with an offset for the number of months enrolled.
[f] Includes children that were aged between 15 and 41 months by June 30, 2023, who were continuously enrolled during the measurement period from 0 to 15 months of age (n = 5226).

in any ED visits over the year (47.0% vs 50.4%, $P = .05$). The effect on 6 or more well-child visits was also stronger for IMPACT sites among the engaged groups, with a 9.6 percentage point higher rate of reaching this target (70.7% vs 61.1%, $P < .001$). Similar to the overall sample, there was also a high rate of dental visits (any and total number) associated with IMPACT for the engaged groups.

Child Outcomes by Race and Ethnicity

Table 4 shows the results for children who were Black or Hispanic. Compared with their Black counterparts seeking primary care at comparison sites, Black children in IMPACT had a significantly higher rate of well-child (2.37 visits vs 2.13 visits, $P = .003$) and primary care visits (3.36 visits vs 3.06 visits, $P = .05$) of 6 or more visits by 15 months (53.3% vs 39.9%, $P < .001$) and of any dental visit (12.9 vs 10%, $P = .04$). For Hispanic children, IMPACT was associated with a 5.1 percentage point increase in 6 or more well-child visits and higher rates of specialty visits but also a slightly lower rate of any primary care visit (90.1% vs 92.9%, $P = .004$). The use of any preventative dental services was particularly high for Hispanic children in IMPACT compared with Hispanic children at the comparison sites (22.3% vs 15.0%, $P < .001$).

Sensitivity Analyses

Results from the regression-adjusted analysis (Supplemental Table 6), which included all children in the treatment and comparison groups and adjusted for the maternal and child characteristics used for matching, were directionally similar to the main analysis but with more outcomes reaching statistical significance. Notedly, the decrease in any ED visits and the winsorized expenditures for children in the treatment group became significant, as did the increase in primary care and well-child visit rates.

In our robustness check using a cross-sectional DiD approach, we found there were mostly parallel trends in the baseline period between children in the IMPACT and comparison sites except for dental care, and results should be interpreted with caution given that dental access appeared to be increasing for IMPACT sites in the preperiod (Supplemental Table 7). The DiD results were largely qualitatively similar in direction to the main analysis, despite a different population and time frame, with a few key insights (Supplemental Table 8). The DiD estimate for any ED visit was directionally similar and significant to the main analysis. Although the proportion of children with any ED visit increased across both IMPACT and comparison sites, it increased less at the IMPACT sites, suggesting the model may have a mitigating effect on larger health system and post-COVID pandemic use trends. The quality measure, 6 or more well-child visits by 15 months, was directionally similar to the main analysis but not significant. This DiD result should be interpreted with caution given the inability to test preparallel trends specific to this outcome, although well-child visit outcomes (any and rates) could be a proxy and satisfied preparallel trend assumptions.

DISCUSSION

In this prospective matched cohort analysis, we demonstrate that IMPACT, an early childhood advanced primary care model within a large public hospital system, can show

TABLE 4. Health Care Use and Quality Measures Among Black and Hispanic Medicaid-Insured Children at IMPACT and Comparison Sites (n = 8562)

Outcome Measures	Black (n = 2692)				Hispanic (n = 5870)			
	Mean IMPACT (n = 1515)	Mean Comparison (n = 1177)	Difference	*P* Value	Mean IMPACT (n = 2828)	Mean Comparison (n = 3042)	Difference	*P* Value
Any use, %[a]								
ED visit	41.2	43.6	−2.4	.31	49.3	49.7	−0.4	.79
Hospitalization	4.5	6.2	−1.7	.19	6.3	7.1	−0.7	.37
Primary care visit	86.5	84.9	1.6	.37	90.1	92.9	−2.2	.004**
Well-child visit	85.8	84.5	1.3	.43	09.5	91.4	−0.9	.29
Specialist visit	33.5	32.0	1.4	.52	40.9	35.1	5.7	<.001***
Dental visit (preventative)	12.9	10.0	2.9	.04*	22.3	15.0	7.3	<.001***
Early intervention services	5.9	4.6	1.3	.18	6.4	6.4	−0.03	.96
Early intervention evaluation	6.6	4.6	2.0	.05	7.4	8.3	−0.9	.29
Lead screening	56.0	58.9	−3.0	.21	66.2	64.8	1.4	.34
Annualized expenditures, $[b]	3536	5279	−1743	.35	4063	3660	404	.38
Winsorized expenditures (1%), $[c]	2556	2897	−341	.43	3118	3323	−206	.42
Use rates (per Medicaid months enrolled)[d]								
ED visit	0.89	0.94	−0.05	.48	1.08	1.10	−0.02	.76
Hospitalization	0.07	0.10	−0.04	.29	0.09	0.08	0.00	.68
Specialist	0.86	0.90	−0.03	.81	1.22	0.91	0.31	<.001***
Primary care visit	3.36	3.06	0.30	.05	4.44	4.53	−0.09	.57
Well-child visit	2.37	2.13	0.24	.003**	2.78	2.75	0.03	.55
Dental visit (preventative)	0.42	0.36	0.05	.33	0.81	0.55	0.25	<.001***
Continuous Medicaid enrollment, %	92.3	90.6	1.8	.18	95.1	94.4	0.7	.36
Medicaid enrollment, months	11.4	11.3	0.09	.37	11.6	11.5	0.12	.07
Quality, %[e]								
6+ well-child visits by 15 months	53.3	39.9	13.4	<.001***	73.3	68.2	5.1	.004**

Abbreviations: ED, emergency department; IMPACT, 3-2-1 IMPACT.

*$P < .05$; **$P < .01$; ***$P < .001$

[a] Linear probability model with robust standard errors.

[b] Gamma distribution, log link.

[c] Winsorized expenditures replace the top 1% of expenditures with the 99th percentile value to reduce the impact of outliers.

[d] Negative binomial with an offset for the number of months enrolled.

[e] Includes children that were aged between 15 and 41 months by June 30, 2023, who were continuously enrolled during the measurement period from 0 to 15 months of age (n = 6210).

short-term, positive effects on preventative and acute care use and quality for children enrolled in Medicaid. In particular, ED rates were lower for children at the IMPACT sites and the proportion of children with 6 or more well-child visits by 15 months was higher, especially for children engaged in primary care and Black and Hispanic children. These results were robust across our sensitivity analyses. Improved engagement in primary care was especially notable for Black children, suggesting the team-based model may foster a more equitable approach to engaging families in pediatric primary care. Of note, although well-child visit rates and counts were nonsignificant in the main analysis and with mixed results in our robustness checks, IMPACT sites' higher performance on a key early childhood quality measure (6+ well-child visits by 15 months) suggests the model may encourage a more thoughtful and diligent approach to population-health quality performance strategies for pediatric primary care, in which many of the screenings, interventions, and programs focus on timely and team-based well-child care.

With 12 recommended encounters in the first 3 years of life, pediatric primary care is the highest-touch sector in a young child's life,[19,26] providing an opportunity to offer parental supports, address social determinants of health, and support families around children's development and social-emotional well-being.[6,13,28] IMPACT's demonstrated positive effects on well-child visit attendance and outpatient service use (ie, dental and subspecialty services), in parallel with decreased ED use, suggests that the model may be addressing family needs that drive emergent care patterns. No differences were seen in inpatient use or early intervention evaluations and services, although the

overall rates are low across the groups and we may be underpowered to detect differences. Medicaid enrollment also did not differ between groups, although the study period overlapped with the continuous enrollment provision mandated by the Families First Coronavirus Response Act of 2020.[29] Improved preventative dental care use, although not an explicit focus of the IMPACT model, was a significant finding, and although robustness checks suggest increases were likely happening prior to the start of IMPACT, this finding may reflect the IMPACT sites' overall investment in pediatric population health, which contributed to a parallel effort to improve dental health.

The results shown here reaffirm prior studies looking at the individual programs that compose the IMPACT model.[3,7,10,11,14,29,30] More research is needed to determine how each program component interacts, additive program effects, and whether the benefits can be sustained long term across mother-child dyads.

Of note, we saw no significant impact on expenditures in our study, although expenditure trends were decreased for IMPACT sites and our regression-based sensitivity analysis did find significantly decreased winsorized expenditures for IMPACT vs comparison sites. A focus on decreasing Medicaid expenditures in this vulnerable population may be short sighted. Health care expenditures for children are much smaller than for adults and have likely contributed to the overall underinvestment in pediatric primary care.[28] More research is needed to look at expenditure trends across the mother-child dyad. This could open opportunities for more robust short-term cost saving.

Despite the economic evidence that the earliest investments in children have the greatest return-on-investment potential,[15,19,31] models like IMPACT—in which parts of the model remain nonbillable—still struggle for financial sustainability within traditional Medicaid policies and rate structures.[8,32–34] Alternative payment models (APMs) can support nonbillable services necessary for these models, but historically, APMs focus on short-term cost savings associated with chronic disease management or decreasing emergent care use, neither of which are prevalent in early childhood.[8,35] Modest improvements in important quality and use outcomes, such as those described here, and the potential for important long-term benefits and savings have motivated some health systems and states to innovate in this space. H+H, in collaboration with one of its largest managed care plans, has implemented an APM pilot to cover the nonbillable services of IMPACT. A few states (eg, Arkansas, Maryland) have implemented APMs to support HealthySteps using process measures tied to model fidelity, often within patient-centered medical home structures.

Limitations

There are several limitations to note. First, despite efforts to balance the treatment and comparison groups on measured variables, there may still be unmeasured confounding. That said, we leveraged a unique opportunity to link mother-child dyads within our Medicaid data to integrate maternal characteristics in our matching design for a more holistic view on family risk. Second, although we attributed children to a site based on the first well-child visit in the time period, it is possible that they changed practices, which would likely weaken the treatment effect. Third, although Medicaid-managed care represents about 85% of children served by the IMPACT program, our evaluation results may not be representative of the full sample of children served by IMPACT. Moreover, given that we had to drop 5.1% of the original treatment group that could not be matched to a comparison, the findings may not be generalizable to all children served by IMPACT. Fourth, the data come from records generated when providers bill for their services but do not capture all aspects of the benefits or care patterns someone may derive from a program. Finally, we were not able to test individual model components but rather focused on the combined effect of several programs under the umbrella of the IMPACT model.

CONCLUSION

Developing early childhood-focused APMs tied to evidence-based program fidelity and improved quality performance across an equity lens offers a potential path for supporting relational health–focused primary care models.[28] Although there are substantial long-term, cross-sector return-on-investment opportunities to support these models, a key challenge is demonstrating short-term, measurable impacts and cost savings. Our results show that IMPACT is associated with short-term gains in well-child visit quality performance and specialty use and decreased emergency care use, without increasing Medicaid expenditures. The program appears to increase primary care engagement for Black children and well-child visit quality (6+ well-child visits by 15 months) for Black and Hispanic children compared with the standard of care. Modest but real improvements in short-term outcomes could justify sustained model investments motivated by the potential long-term impact for children enrolled in Medicaid. Further investigation is underway to look at outcomes for children experiencing the full length of the IMPACT program through ages 0 to 4 years, including longer-term expenditures, use, and quality outcomes of the child and across the linked mother-child dyad.

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ABBREVIATIONS

APM: alternative payment model

DiD: difference-in-differences
ED: emergency department
H+H: New York City Health + Hospitals
IMPACT: 3-2-1 IMPACT
NYS: New York State
SMD: standardized mean difference.

The views and opinions expressed in this material are those of the author and do not necessarily reflect the official policy or position of the New York Department of Health. Examples of analyses performed in the material are only examples. They should not be used in real-world analytic products.

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