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Impact of the New Jersey In-Home Asthma Intervention Pilot Project on NJ FamilyCare Utilization and Spending

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Executive Summary

Poor management of pediatric asthma may lead to frequent exacerbations that require recurrent emergency department (ED) visits and hospitalization, and missed school and caregiver workdays. In 2019, about 44.3% of children with asthma had one or more asthma attacks in the past 12 months. Asthma symptoms can be triggered by indoor and outdoor environmental exposures, as well as by poor medication adherence. Adequate asthma management requires a comprehensive approach including prevention strategies, education, and long-term medication adherence. Engaging community health workers (CHW) for delivering self-management education has been shown to be a culturally appropriate and cost-effective strategy for improving adherence to treatment, providing education and support to families and improving overall health outcomes.

The Nicholson Foundation (TNF) launched the New Jersey In-home Asthma Intervention Pilot Project in 2017 to test the effectiveness of the CHW-led in-home-visiting model for improving asthma outcomes among children aged 2-17 years who were enrolled in NJ FamilyCare (i.e., Medicaid or CHIP). To adapt the New England Asthma Innovation Collaborative Program for New Jersey, TNF funded four New Jersey-based organizations to implement the model: Health Coalition of Passaic County, Rutgers School of Nursing and Rutgers NJ Medical School Department of Pediatrics (delivered by the Newark Community Health Center), Jersey Shore University Medical Center, and Henry J. Austin Health Center. Additionally, TNF funded Health Resources in Action (HRiA) that developed the original Collaborative Program, to provide technical assistance and training support to the grantees and to assess the impact of New Jersey CHW home-visit model on pediatric patients' asthma control. Rutgers Center for State Health Policy (CSHP) received funding from the New Jersey Department of Health to conduct a Return on Investment (ROI) Analysis of the New Jersey Pilot Project, using the NJ FamilyCare data linked to pilot program roster information.

Target Population

- Children ages 2-17 years enrolled in NJ FamilyCare¹ with poorly controlled asthma.

¹ In this report "Medicaid" includes enrollees in the Children's Health Insurance Program (CHIP). New Jersey refers to its Medicaid/CHIP program as "NJ FamilyCare."

- Inclusion: children with either two or more asthma-related ED visits (including observational stays) or one asthma related inpatient stay in the past year.
- Exclusion: children were excluded if they were being seen for their first asthma-related ED visit (no previous diagnosis of asthma), had certain other medical conditions such as sickle cell or cystic fibrosis, were participating in another in-home asthma intervention or participated in one within the past 12 months, or were experiencing homelessness.

The In-Home Asthma Intervention

The Pilot sites started recruitment in July 2018 and completed the home visits and follow-up by December 2020. Eligible families who consented to participate were provided with three home visits and a follow-up phone call six months after the first visit. CHWs at the four pilot sites collected data during these visits and shared with HRiA for analysis.

Key Findings from In-Home Intervention

Overall, 180 families received at least one home visit from the CHW between July 2018 and August 2020. However, the complete data was available for 161 (89.4%) families. Most enrolled children were either Hispanic/Latino (53.4%) or Black/African American (41.6%) and were between the ages of 4 and 11 years (64.6%). Findings show that key indicators of asthma trigger exposure and control improved for enrolled children and families. The number of children with confirmed written asthma action plan increased significantly (30.4% at visit 1 to 69.6% at visit 3, $p < 0.001$). The overall asthma environment trigger composite score, that was computed based on all environmental questions and CHW room observation checklists, was significantly lower in visit 3 compared to visit 1 (2.5 vs. 3.2, $p < 0.001$). Although one child per family was enrolled in the intervention, whole families may have benefited.

NJ FamilyCare Return on Investment (ROI) Evaluation

Of the $n=180$ children who were enrolled in the Pilot intervention and received at least the first home visit, $n=109$ (60.6%) are included in the NJ FamilyCare outcome analysis. Using econometric methods comparing $n=109$ children enrolled in the Pilot intervention (“index children”) to $n=522$ matched comparison group, CSHP addressed four research questions:

1. To what extent did the New Jersey In-home Asthma Intervention Pilot Project reduce ED visits and hospitalizations?
2. To what extent did the Pilot Project affect primary care provider (PCP) visits?
3. To what extent did the Pilot Project affect total NJ FamilyCare spending, and spending for ED visits, hospitalizations, pharmacy costs, PCP visits, and all other services?
4. If NJ FamilyCare spending was reduced, how do savings compare with program costs?

Key NJ FamilyCare ROI Evaluation Findings

Analysis using NJ FamilyCare claims for N=109 index children matched to N=522 person-quarter observations from the sample of non-participating children did not find that the In-Home Asthma Pilot Project led to reductions in emergency department, inpatient, or total NJ FamilyCare spending, as hypothesized. In fact, some results indicated higher spending, although this was sensitive to model specifications. This finding may stem from programmatic or methodological considerations, or both. The program faced many recruitment challenges from the beginning and the number of families recruited fell short of goals, thus the analysis lacked adequate statistical power.

Intervention Costs Analysis

To measure financial investments in the CHW led In-home Asthma Intervention, CSHP collected the costs data from the grantees using the Return-on-Investment Template (ROI) developed by the Center for Health Care Strategies. The cost estimates were collected for: 1) pre-intervention costs (costs related to developing the intervention), 2) program costs (costs related to implementing the intervention over time), and 3) other training and support costs. CSHP considered two types of analyses contingent on the identified NJ FamilyCare cost savings:

- Return on Investment (ROI) – if NJ FamilyCare savings exceeded program cost
- Cost-Effectiveness Analysis (CEA) – if NJ FamilyCare savings were measured but were less than program cost

Key Cost Analysis Findings

Analysis of NJ FamilyCare claims did not show savings, thus neither ROI nor CEA analysis was possible. Overall, \$1.04 million (not inflation adjusted) was spent across four sites for developing and implementing the intervention from January 2018-December 2020. The average cost per enrolled family was \$5,795. This estimate is likely higher than program costs for fully operational programs not in a start-up phase.

Conclusion

The CSHP evaluation of NJ FamilyCare utilization and spending had potential to generate stronger evidence of impact, but ultimately it did not find that the Pilot led to decrease in healthcare spending or utilization. Low recruitment weakened the ability to detect meaningful changes. The in-home assessment demonstrated that the program was effectively delivered, and the whole family benefitted from the program. The results suggest the merits of CHW led in-home intervention model and further research should consider and address the challenges identified in this study.

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Introduction

Pediatric asthma is a common chronic respiratory condition that imposes substantial burdens on patients, caregivers, and health care systems. According to the Centers for Disease Control and Prevention (CDC) estimates, 7.0% (5.1 million) of children under the age of 18 in the US reported having asthma in 2019.¹ The prevalence was higher among young teens (0-4 years=2.6%, 5-11=9.1%, 12-14=10.8%, and 15-17=7.0%), boys (boys=8.4%, girls=5.5%), populations with lower socioeconomic status (<100% of the federal poverty threshold=11.8%; 100% to less than 250%=8.5%; 250% to less than 450%= 7.3%; and 450% or higher=5.9%). In addition, the burden of asthma was disproportionately higher among minority groups (non-Hispanic Black=13.5%, multi-racial group=11.2%, American Indian/Alaskan Native=8.2%, and Hispanic=7.5% children when compared to non-Hispanic Whites=6.4%). Furthermore, the prevalence of asthma was higher among New Jersey children (9.1%) compared to the national average.²

Asthma symptoms can be triggered by indoor and outdoor environmental exposures such as secondhand smoke, dust mites, pets, molds, air pollution, and chemical irritants, as well as by poor medication adherence.³ Poor management of asthma may lead to frequent exacerbations that require recurrent emergency department (ED) visits and hospitalization, and missed school and caregiver workdays. In 2019, about 44.3% of children with asthma had one or more asthma attacks in the prior 12 months.⁴ Moreover, based on the CDC estimates, there were over 750,000 asthma related emergency department visits and over 74,000 hospitalizations among children in 2018.⁵

Prevention and long-term medication adherence are key factors in keeping asthma under control. Asthma can be effectively managed outside the acute care setting by educating patients and caregivers about how to recognize and respond to in-home and environmental triggers, working with families to develop adequate medical management plans, teaching families the appropriate use of medications and inhaler, and informing child care centers/schools/other caregivers about their child's specific needs and triggers.⁶ Research has shown that implementing multi-trigger, multicomponent community-based interventions to improve asthma-related health outcomes have positive impacts on the health of children with asthma.⁷ Addition of the home visiting component to medical care may help with better self-management by filling

knowledge gaps, improving adherence to medications, and recognizing and reducing environmental triggers.⁸

Engaging community health workers (CHW) for delivering self-management education has been shown to be a culturally appropriate and cost-effective strategy for providing support to children with asthma and their caregivers.^{9,10} CHWs in home-visiting models are typically lay workers from the community served. They understand the language and culture of the communities they serve and can be liaisons between healthcare providers and the community. They provide ongoing outreach to families to reinforce positive problem-solving, help address other social determinants of health issues, provide education to prevent disease exacerbations, avert nonessential ED visits or hospitalizations among children with high healthcare utilization, which may ultimately translate to reduced healthcare costs.^{11,12} The economic benefits of strategies such as family education, environmental assessment, and low-cost interventions to improve home and surroundings outweigh the costs incurred for children with poorly controlled asthma.¹³ Moreover, the approach benefits the whole family as the intervention is offered at a household level, so the actual cost savings may be underestimated.¹⁴

Background

To test the effectiveness of a CHW-led home-visiting model for improving asthma outcomes among children aged 2-17 years who were enrolled in NJ FamilyCare (i.e., Medicaid or CHIP), the Nicholson Foundation (TNF) launched the New Jersey In-home Asthma Intervention Pilot Project in 2017. This multi-faceted intervention was an adaptation of the New England Asthma Innovation Collaborative Program, and was designed to support caregivers in the management of their asthmatic children's symptoms to improve asthma outcomes and quality of care and to reduce NJ FamilyCare spending related to poorly managed asthma among children. Working with Health Resources in Action (HRiA) which developed the original Collaborative Program, TNF funded four New Jersey-based organizations to implement the home-visiting model in New Jersey: Health Coalition of Passaic County, Rutgers School of Nursing and Rutgers NJ Medical School Department of Pediatrics (delivered by the Newark Community Health Center), Jersey Shore University Medical Center, and Henry J. Austin Health Center.

HRiA received funding from TNF to provide technical assistance and training support to the grantees, and to assess outcomes of the New Jersey CHW home-visit model on pediatric patients' asthma control. Rutgers Center for State Health Policy (CSHP) received funding from the New Jersey Department of Health to conduct a Return on Investment (ROI) Analysis of the New Jersey Pilot Project, using the NJ FamilyCare data linked to pilot program roster information. The

objectives of the CSHP analysis were to: (1) evaluate changes in participants' NJ FamilyCare-funded health services use and spending relative to a matched non-intervention comparison group over 12-months pre- and post-enrollment (after the first CHW visit date), and (2) analyze the cost, and possibly cost-effectiveness or return on investment, of the intervention.

The Pilot Intervention

This section describes the program and summarizes findings of HRiA's program assessment.

Target Population

The program sought to enroll children ages 2-17 years enrolled in NJ FamilyCare² with poorly controlled asthma. To reflect poor asthma control, the intervention included patients with either two or more asthma-related ED visits (including observational stays) or one asthma related inpatient stay in the past year. Patients were excluded if they were being seen for their first asthma-related ED visit (no previous diagnosis of asthma), had certain other medical conditions such as sickle cell or cystic fibrosis, were participating in another in-home asthma intervention or participated in one within the past 12 months, or were experiencing homelessness.

Program Assessment Results at a Glance

Using data collected from enrolled families at the four Pilot sites, HRiA found that the program was implemented effectively. Key indicators of asthma management and control improved among participants.

The In-Home Asthma Intervention

The intervention was based on a minimum-staffing model that employed a CHW and a clinical supervisor. The CHWs identified and recruited eligible patients and scheduled a screening interview with caregivers to ensure all inclusion and exclusion criteria were met. Eligible families who consented to participate were then provided with three home visits and a follow-up phone call six months after the first visit. Project CHWs collected data during these visits and the phone call. The Pilot sites started recruitment in July 2018 and completed the home visits and follow-up by December 2020. The following activities/materials were included during the home visit:

- Home visit 1: The CHW administered informed consent, delivered asthma management education to the patient's caregiver(s), provided referrals to healthcare providers or social services (if needed), reviewed medications and patient's asthma action plan, interviewed the caregiver, and conducted an environmental assessment.
- Home visit 2: conducted 2 weeks after visit 1. The CHW delivered the required environmental asthma management supplies such as High-Efficiency Particulate Air (HEPA) filter vacuum

² In this report "Medicaid" includes enrollees in the Children's Health Insurance Program (CHIP). New Jersey refers to its Medicaid/CHIP program as "NJ FamilyCare."

cleaner with low ozone emissions, dust-mite-proof mattress and pillowcase encasement, pest management supplies, “green” cleaning supplies, and other optional supplies such as an air conditioner and air filters; and provided supplemental education to the caregivers as needed.

- Home visit 3: conducted 4-6 weeks after second home visit. CHW interviewed caregivers, re-conducted the environmental assessment, and provided additional asthma management education.
- Follow-up phone call: conducted 6-months after visit 1. The CHW interviewed caregivers and re-conducted the environmental assessment.

HRiA Data collection tools

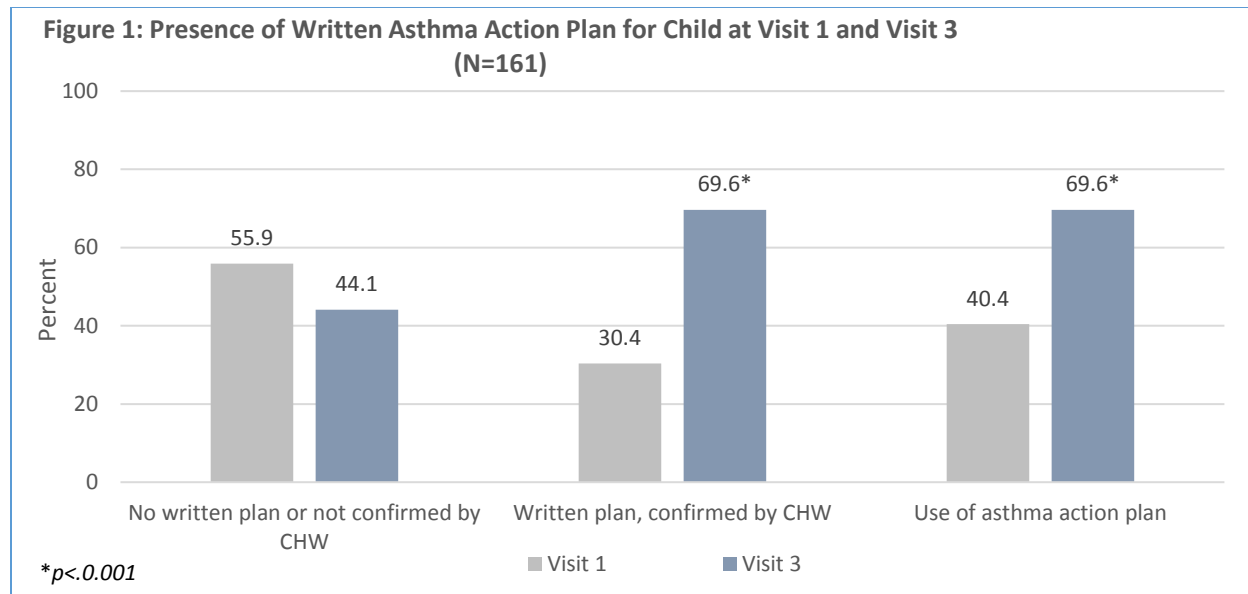
CHWs used three instruments to collect data during home visits and calls and submitted the completed data to HRiA for analyses via a secure online data collection system.

- Caregiver questionnaire: used to assess different dimensions of asthma control as well as quality of life.
- Asthma control scale: a validated scale to assess the degree of asthma control in the enrolled child. The scale was selected based on child’s age: Test for Respiratory and Asthma Control in Kids (TRACK) for children under 4 years, the Childhood Asthma Control Test (Childhood ACT) for children between 4 and 11 years, and the Asthma Control Test (ACT) for children aged 12 years and older.
- Environmental assessment: used to assess the presence of environmental asthma triggers in the home.

HRiA Program Assessment Findings

Overall, 180 families received at least one home visit from the CHW between July 2018 and August 2020. However, the complete data was available for 161 (89.4%) families. Most enrolled children were either Hispanic/Latino (53.4%) or Black/African American (41.6%) and were between the ages of 4 and 11 years (64.6%). About 7 in 10 (70.8%) caregivers either completed high school or some college or vocational training, 23.6% completed less than high school, and 5.0% graduated college. Household composition data showed that 35.4% of families had at least one other child in the home with asthma, in addition to the index child, and 39.8% of families had at least one adult in the home with asthma.

Changes in Asthma Management (Figure 1): the proportion of caregivers that had a confirmed written asthma action plan increased significantly from 30.4% at visit 1 to 69.6% at visit 3 ($p<0.001$). Moreover, there was a statistically significant increase in the use of written asthma action plan from visit 1 to visit 3 (40.4% vs. 69.6%, $p<0.001$).

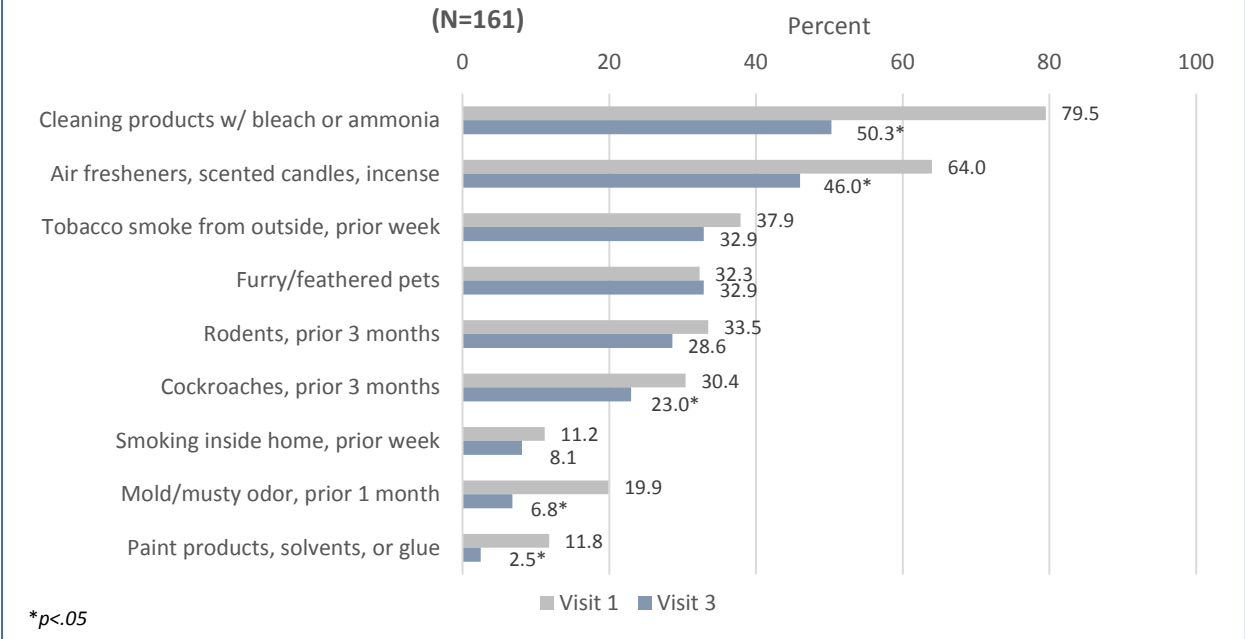


Changes in Environmental Triggers (Figure 2): The environmental assessment data indicated many homes had significant asthma triggers present at visit 1. At visit 3, statistically significant fewer triggers were observed for:

- Use of cleaning products containing bleach or ammonia (79.5% vs. 50.3%, p<0.001)
- Air fresheners, scented candles, or incense (64.0% vs. 46.0%, p<0.001) in the home
- Presence of cockroaches (30.4% vs. 23.0%, p<0.05)
- Mold/musty odor (19.9% vs. 6.8%, p<0.05), pain products, solvents, or glue (11.8% vs. 2.5%, p<0.05)

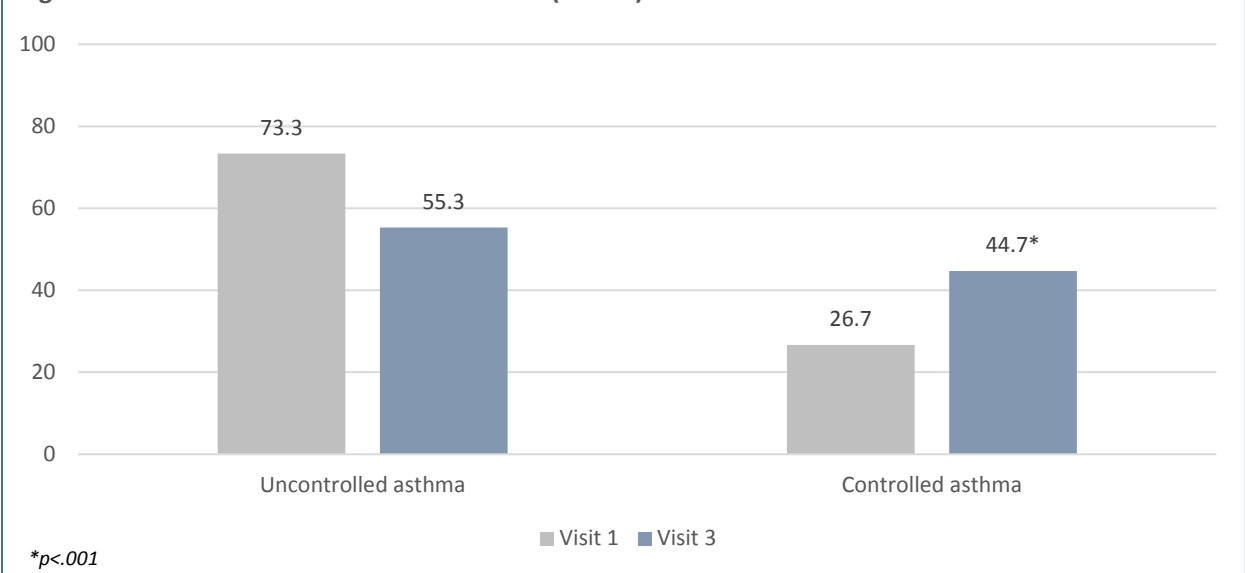
The overall asthma environment trigger composite score, that was computed based on all environmental questions and CHW room observation checklists, was significantly lower in visit 3 compared to visit 1 (2.5 vs. 3.2, p<0.001).

Figure 2: Caregiver Reported Asthma Triggers in the Home at Visit 1 and Visit 3



Improvement in Asthma Control (Figure 3): Using an age-appropriate, validated asthma control scale, from visit 1 to visit 3, there was a statistically significant increase in the percentage of children experiencing controlled asthma (26.7% vs. 44.7%, $p < 0.001$). Further analyses also showed that asthma control was significantly better for children in families where the caregiver had either a confirmed asthma action plan or a decrease in the overall environmental composite score at visit 3 ($p < 0.05$).

Figure 3: Asthma Control at Visit 1 and Visit 3 (N=161)



Six-month Follow-up Data: Nearly half of the caregivers were lost to follow-up. Therefore, these exploratory analyses were limited to 86 families. Findings reflect improvements in a number of important measures including the number of missed days of work/school (for caregivers) and number of missed days of school/childcare (for enrolled children). There was a median decline of 2.5 missed days among caregivers and a median decline of 4 missed days among index children. The proportion of caregivers who used asthma action plan further increased (visit 1=46.5%, visit 2=70.9%, follow-up=72.1%), and the reductions in the presence of cleaning products with bleach or ammonia and use of air fresheners, scented candles, or incense that were achieved between home visit 1 and home visit 3 were also sustained at the evaluation follow-up timepoint.

HRiA Analysis Conclusion

Findings show that key indicators of asthma trigger exposure and control improved for enrolled children and families. Although one child per family was enrolled in the intervention, whole families may have benefited. Despite the enormous challenges posed by the COVID-19 pandemic during the final months of the project, these findings suggest that the CHW-led intervention effectively provided personalized education to caregivers and helped them adopt skills and behaviors needed to recognize and effectively manage their child's symptoms.

NJ FamilyCare Return on Investment (ROI) Evaluation

Overview

As described above, the objectives of the ROI Analysis of the Pilot Project were to: (1) evaluate changes in participants' NJ FamilyCare-funded health services use and spending relative to a matched non-intervention comparison, and (2) analyze the cost, and possibly cost-effectiveness or return on investment, of the intervention. This section summarizes the key findings from these analyses, addressing four research questions:

1. To what extent did the New Jersey In-home Asthma Intervention Pilot Project reduce ED visits and hospitalizations?
2. To what extent did the Pilot Project affect primary care provider (PCP) visits?
3. To what extent did the Pilot Project affect total NJ FamilyCare spending, and spending for ED visits, hospitalizations, pharmacy costs, PCP visits, and all other services?
4. If NJ FamilyCare spending was reduced, how do savings compare with program costs?

This section describes the analysis of NJ FamilyCare utilization and spending outcomes followed by a section describing the program cost analysis.

Data and Methods

Study Population. Of the n=180 children who were enrolled in the Pilot intervention and received at least the first home visit, n=109 (60.6%) are included in the NJ FamilyCare outcome analysis. Children excluded from this analysis were: a) missing Pilot enrollment information, b) not enrolled in NJ FamilyCare³ for at least 300 days each year over the study period (June 2018–June 2020), c) had a diagnosis of sickle cell disease or cystic fibrosis, d) were not in the age range of 3-18, or 5) could not be matched with comparison children (discussed below). Having insufficient NJ FamilyCare enrolled days accounted for the largest portion of exclusions (25%), and each of the other reasons for exclusions accounted for 6% or fewer excluded cases. Two-year-old children were eligible for the intervention but are excluded from the ROI analysis to

ROI Evaluation Results at a Glance

The NJ FamilyCare outcome evaluation did not find an association between program participation and improvements in most NJ FamilyCare utilization or spending outcomes. This result may stem from either programmatic or methodological considerations, or both. Since NJ FamilyCare savings were not documented, cost-effectiveness or ROI analysis is not possible. The intervention cost \$5,795 per family over three years. This estimate is likely higher than program costs for fully operational programs not in a start-up phase.

³ Including enrollees in the Children's Health Insurance Program (CHIP)

ensure an adequate pre-intervention baseline observation period. A separate analysis of siblings of enrolled index children was also conducted. A random sibling was selected in families with more than one. A total of n=60 siblings were matched to n=297 person-quarter observations of non-intervention children for this analysis.

Data and Linkage Strategy. Using comprehensive NJ FamilyCare claims and enrollment data, index children enrolled in the Pilot intervention and, separately, their siblings were matched to children not served by the intervention. Matching was conducted in two steps. First, each intervention child was matched to a pool of potential matched comparison children with the same: 1) number of ED visits in the four quarters prior to enrollment, 2) number of inpatient admissions in the prior four quarters, 3) race/ethnic category (Hispanic/Latinx or non-Hispanic white, Black, or Asian/other race), 4) sex (male, female), 5) NJ FamilyCare eligibility group, 6) four categories of Chronic Illness and Disability Payment System (CDPS) risk groups, and 7) calendar year-quarter of the match.

Second, from the pool of exact matches, Mahalanobis minimum distance matching using the “mahapick” procedure in STATA 16.0 was applied based on: 1) number of days enrolled in NJ FamilyCare, 2) age, 3) pediatric asthma admission rate in the child’s zip code (2017), and 4) the share of structures built before 1940 in the child’s zip code (2017).¹⁵ The two area-level measures are included to capture variations in the presence of environmental asthma triggers and availability of high-quality ambulatory care in each child’s neighborhood. Except where noted, matching characteristics were calculated for the four quarters prior to the year and quarter of the match, i.e., quarter of Pilot intervention enrollment. Table 1 below shows the balance of characteristics of index and matched comparison children.

Table 1: Index and Matched Comparison Child Panel Characteristics

	Comparison child		Treated child		Std Diff
	Mean	SD or (%)	Mean	SD or (%)	
Pediatric asthma admission rate in zip code	0.0017	0.0010	0.0017	0.0012	-0.0544
Share of residential structures built before 1940	28.1900	15.6290	30.4400	20.0270	-0.1256
No. of ED visits prior 4 quarters*	1.2640	1.2450	1.2940	1.2495	-0.0234
No. of IP admissions prior 4 quarters*	0.2452	0.4608	0.2844	0.5287	-0.0790
Number of days enrolled in previous 4 quarters	364.3000	6.1491	361.8000	17.5180	0.1900
Child age	8.1860	3.8645	7.7710	3.5659	0.1117
Male*	0.5441	0.4985	0.5321	0.5013	0.0239
CDPS risk score*	2.2390	1.3122	2.2480	1.3134	-0.0063

Notes: 109 index intervention children were matched to 522 comparison person-quarter observations comprising 623 unique persons. Asterisk (*) indicates exact matching. Treatment and comparison populations were also exact matched on the following characteristics (standardized difference in parentheses): calendar year-quarter of enrollment (-0.00627), race/ethnicity (-0.03343) and NJ FamilyCare eligibility group (0.05381).

Outcome Measures and Hypotheses. Nine outcomes, each measured quarterly, were examined: 1) ED visits coded with an asthma diagnosis, 2) inpatient (IP) admissions coded with an asthma diagnosis, 3) primary care visits, 4) spending on asthma-related ED visits, 5) spending on asthma-related IP stays, 6) spending on primary care visits, 7) spending for prescription drugs, 8) other NJ FamilyCare spending, and 9) total NJ FamilyCare spending. Asthma ED and IP utilization was identified by the presence of any ICD-10 code indicating asthma (J45.20, J45.21, J45.22, J45.30, J45.31, J45.32, J45.40, J45.41, J45.42, J45.43, J45.50, J45.51, J45.52, J45.901, J45.902, J45.909, J45.990, J45.991, J45.998) on any diagnostic field for any claim in the four quarters pre-intervention. Primary care visits were defined as evaluation and management visits to a PCP in an ambulatory setting with HCPCS/CPT codes for outpatient or preventive care visits or consultations (99201-99215; 99241-99245; or 99381-99397). Zip-code level pediatric asthma rates utilized Agency for Healthcare Research and Quality Prevention Quality Indicator (PDI-14); and zip-code level estimates of structures built before 1940 were from the American Community Survey.^{16,17}

We hypothesized that ED and IP utilization and spending and total NJ FamilyCare spending would be reduced by the intervention and that primary care use and spending would increase. The intervention may have either increased or decreased spending for prescription drugs or “other” services as families may have reduced use of avoidable services (e.g., rescue inhalers) or increased use of preventive, asthma management, and other essential care.

Analysis. Quarterly trends in outcomes for index children (i.e., those enrolled in the Pilot intervention) and siblings were separately examined over the study period from June 2018 to June 2020 relative to their respective matched comparison groups. Matching was conducted during the quarter of the first home visit for each intervention child. Data are available for at least 5 quarters pre-intervention and at least 1 quarter post-intervention. The average pre-intervention and post-intervention period (not counting the quarter during which the intervention was initiated) are 8.7 and 6.3 quarters respectively. We applied difference-in-differences (DD) methods, a means for making causal inferences about program effects when randomization is not possible.¹⁸ Because matching by age did not meet the conventional level of comparability, models were adjusted for child age. Models were estimated based on quarterly data and controlled for year and quarter of match. Since enrollment can take place either early or late in the quarter of program enrollment, we tested the sensitivity of results in models that excluded the quarter of enrollment.

Findings

Figure 1 summarizes results for index child DD models and Table 2 shows the DD estimates. Most findings were either not statistically significant or significant but counter to hypotheses. Our results indicated that participation in the Pilot led to *higher* utilization of ED and IP services, contrary to our hypothesis. We did find higher spending for primary care post-intervention, but this result was sensitive to inclusion of the quarter of program enrollment. No results were statistically significant in models comparing siblings to their matched comparison children.

Figure 1: Summary of Results for Index Child DD Models

Outcome	Hypothesis	Estimated Program Impact
Asthma-related ED visits	Decrease	Increase
Asthma-related ED spending	Decrease	No change
Asthma-related IP stays	Decrease	Increase*
Asthma-related IP spending	Decrease	No change
Primary care visits	Increase	No change
Primary care spending	Increase	Increase*
Prescription drug spending	---	No change
Other spending	---	No change
Total spending	Decrease	No change

NOTES: Results shown are from models that include the quarter of enrollment, asterisks (*) indicate that findings were not significant in models that exclude the enrollment quarter. Spending estimates are adjusted for time enrolled in NJ FamilyCare. See text for abbreviations.

Table 2: Difference-in-Differences Estimation of Program Effects

	Baseline Mean	Coefficient	Standard Error	P Value
ED Visits with asthma	0.2422	0.0866***	(0.0322)	0.007
IP Visits with asthma	0.0410	0.0264**	(0.0120)	0.029
PC Visits	1.0478	0.1582*	(0.0902)	0.080
Total Spending	2531.3150	287.9061	(417.1440)	0.490
ED Spending for asthma	97.2470	24.4361*	(13.7981)	0.077
IP spending for asthma	312.2778	213.7682	(146.2820)	0.144
Pharmacy spending	355.5491	-66.4343	(171.9033)	0.699
Primary Care spending	61.5691	21.4934**	(9.5584)	0.025
Other Spending	1519.1240	187.2721	(301.4695)	0.535
Sensitivity Analysis: Dropping the quarter of matching				
ED Visits with asthma	0.2422	0.0663**	(0.0314)	0.035
IP Visits with asthma	0.0410	0.0111	(0.0110)	0.312
PC Visits	1.0478	0.0830	(0.0953)	0.384
Total Spending	2531.3150	-49.0877	(441.0144)	0.911
ED Spending for asthma	97.2470	16.8776	(13.3544)	0.207
IP spending for asthma	312.2778	15.9287	(124.7754)	0.898
Pharmacy spending	355.5491	-92.1549	(188.9840)	0.626
Primary Care spending	61.5691	16.9606*	(10.1449)	0.095
Other Spending	1519.1240	95.7576	(326.3556)	0.769

Notes: N= 10,096 for main specification in top panel and N=9465 for specification dropping matching quarter in lower panel. Unit of analysis is person-quarter. IP: Inpatient; ED: Emergency Department.

Conclusion

Analysis using NJ FamilyCare claims for N=109 index children matched to N=522 person-quarter observations from the sample of non-participating children did not find that the In-Home Asthma Pilot Project led to reductions in emergency department, inpatient, or total NJ FamilyCare spending, as hypothesized. In fact, some results indicated higher spending, although this was sensitive to model specifications. This finding may stem from programmatic or methodological considerations, or both.

The Pilot program sites had considerable difficulty recruiting eligible patients. Immigration policy and politics may have deterred some families from enrolling. The sites also reported difficulty establishing strong referral sources. Starting in March 2020, pandemic restrictions required home visits to be virtual, raising additional challenges. Ultimately, the number of families recruited fell short of goals, thus the NJ FamilyCare utilization and spending analysis lacked adequate statistical power. We estimate that to be able to statistically detect a \$400 reduction in NJ FamilyCare spending per child, approximately 1,000 index children would be needed. Only

about 18% of that number were ultimately recruited, and about a third of those did not have data available for analysis. Finally, while difference-in-differences analysis is a valuable method for establishing causal inferences, it is not as strong as randomized designs in ruling out possible sources of selection bias.

Intervention Costs Analysis

To measure financial investments in the CHW led In-home Asthma Intervention, CSHP collected the costs data from the grantees using the Return-on-Investment Template (ROI) developed by the Center for Health Care Strategies.¹⁹ The Template allows users to track investments incurred both for developing and implementing an intervention.

Data and Methods

Grantees used the Cost Template shared by CSHP and submitted estimates of:

- Pre-intervention costs: costs related to developing the intervention
- Continuing costs: costs related to implementing the intervention over time
- Other training and support costs

The categories in the Template included costs for project personnel (salary and fringe), office operations (rent, utilities, travel, telephone etc.), other operating costs, and indirect costs. Non-recurring costs such as expenses associated with reporting requirements or evaluation were excluded from the estimates. CSHP considered two types of analyses contingent on the identification of NJ FamilyCare cost savings:

- Return on Investment (ROI) – if NJ FamilyCare savings exceeded program cost
- Cost-Effectiveness Analysis (CEA) – if NJ FamilyCare savings were measured but were less than program cost

Assumptions

All grantees were part of large organizations and did not directly pay for rent and utilities costs. Thus, based on several assumptions we imputed occupancy cost (rent, utilities, maintenance). We assumed 300 gross (including shared space) square feet of office space per full-time equivalent personnel reported by the sites. After exploring the cost for renting an office near grantee sites, we applied an average of \$20/square foot for rental cost calculations. Additionally, we calculated indirect costs, after excluding space-related cost from direct costs, as 10% of direct costs, the amount permitted by the Nicholson Foundation.

Results

Overall, \$1.04 million (not inflation adjusted) was spent across the four sites for developing and implementing the intervention from January 2018 to December 2020 (see Table 1). Personnel costs contributed to 70.5% of overall costs, followed by space costs (12.0%), program supplies (6.3%) and other related costs (3.2%). The average cost of enrolling a family was \$5,795 (range: \$4,803-\$7,228 across the four sites).

Cost Category	Total	% of Total	Range Across Sites
Personnel	\$ 735,321	70.5%	\$94,650- \$246,810
Program supplies	\$65,912	6.3%	\$6,273- \$38,170
Other costs	\$33,287	3.2%	\$3,270-\$17,541
Occupancy (imputed)	\$125,065	12.0%	\$9,840-\$50,365
Total Direct	\$959,585		\$118,343- \$340,235
Indirect @10% of direct cost (excluding occupancy)	\$83,452	8.0%	\$10,850-\$29,818
Grand Total	\$1,043,037	100.0%	\$129,194-\$370,053

Conclusion

As discussed in the prior section, analysis of NJ FamilyCare claims did not show savings, thus neither ROI nor CEA analysis was possible. The average cost per enrolled family was \$5,795. However, it is important to note that recruitment was a challenge from the beginning and the COVID-19 Pandemic made it more difficult to recruit children. Because projects were staffed for larger enrollment and greater than expected effort was required for recruitment, it is unlikely that the sites operated at an efficient scale. Thus, costs per enrollee would likely be lower for fully operational programs.

Discussion

The In-Home Asthma Intervention Pilot Project was implemented and delivered successfully, despite significant challenges recruiting eligible families and delivering the intervention during the pandemic. Community Health Workers (CHW) were successfully hired and trained, and they delivered numerous home visits. The HRiA assessment demonstrated that the program was effectively delivered, and indicators of improvement were documented. These results are very encouraging, but because the assessment did not include a comparison sample, it cannot be interpreted as evidence of program impact.

The CSHP evaluation of NJ FamilyCare utilization and spending had potential to generate stronger evidence of impact, but ultimately did not find that the Pilot led to improved outcomes. Low recruitment significantly weakened the ability of the NJ FamilyCare analysis to detect changes in outcomes. In addition, while well-established causal inference analytic methods were used, our non-randomized evaluation design leaves room for possible mismeasurement. Because no savings to NJ FamilyCare were documented, formal return-on-investment or cost-effective analysis was not warranted. Based on data provided by the sites and assumptions about space/occupancy costs, the intervention cost averaged \$5,795 per enrolled family, although it is likely that this cost would be lower for a fully operational program.

While this project did not yield evidence of the effectiveness or cost effectiveness of a CHW home-visiting intervention for children enrolled in NJ FamilyCare, prior studies of CHW interventions show great promise.²⁰ Further work is needed to develop and test such interventions serving NJ FamilyCare populations.

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