

August 2024

Connecticut Department of Public Health  
Putting on AIRS Program  
Economic Evaluation Summary Report



Connecticut State  
**Department of Public Health**

Connecticut Department of Public Health Asthma Program  
Putting On Airs Program Economic Evaluation Summary Report  
August 2024

*Prepared by  
The Consultation Center, Inc.*

Yale**EV**AL



Connecticut State  
**Department of Public Health**

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*Putting on AIRS (Asthma Indoor Risk Strategies) is an asthma home visiting program designed by the Connecticut Department of Public Health Asthma Program to improve an individual's asthma control and self-management by reducing environmental asthma triggers in the home and providing education for self-management of asthma symptoms.*

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## Introduction

The Connecticut Department of Public Health Asthma Program (CAP) is committed to reducing asthma disparities and improving access to comprehensive asthma control management through targeted initiatives, partnerships, surveillance, and supporting policies to improve indoor and outdoor air quality.

With funding provided through a cooperative agreement from the Centers for Disease Control and Prevention (CDC), CAP designed the Putting on AIRS (Asthma Indoor Risk Strategies) program in 2007, which aims to mitigate asthma triggers in homes and enhance asthma management through education and environmental interventions. The program was modified in 2016 and is implemented through contracts with local health department staff including, nurses and respiratory therapists as Certified Asthma Educators (AE-C), working with community health workers to provide asthma education and sanitarians to assess in-home asthma triggers and recommend remediation strategies to reduce environmental exposure.

A requirement of the CDC 2019–2024 cooperative agreement was to conduct an economic evaluation of the Putting on AIRS program. The Consultation Center, Inc. (TCC) was hired to collaborate with CAP to design an economic evaluation to determine the extent to which Putting in AIRS is reducing asthma-related medical costs. Contractor financial reports, program participant self-reported data, and medical charge data including frequency of asthma-related emergency room visits and hospitalizations were analyzed to assess asthma-related costs and potential savings.

## Asthma Burden in Connecticut

Asthma is a chronic health condition that affects 25 million individuals in the United States, constituting 10.5% of the population<sup>1</sup>. Connecticut ranks among the top 15 states with the highest percentage of adults with asthma. Connecticut Asthma Statistics for 2022 reveal that 8.2% of children and 12.4% of adults had asthma<sup>2</sup>. Asthma hospitalizations and emergency department visits in 2022 were reported at 7.2 and 46.2 per 10,000 population, respectively. Rates were lower in 2020 and 2021 than in previous years due to the Coronavirus 2019 (COVID-19) pandemic, but the rates for 2022 seemed to have normalized to pre-COVID-19 levels<sup>3</sup>.

### *Asthma-related health disparities*

Health disparities are notable, particularly affecting women and residents of Hispanic and non-Hispanic Black communities in Connecticut. In 2022, 15.7% of adult women were estimated to have current asthma, a higher proportion than the overall statewide adult prevalence of 12.4%.<sup>2</sup> While the 2022 total statewide rate of emergency department visits for asthma was 46.2, among the Black, non-Hispanic and Hispanic communities the rate was higher; 103.5 and 80.0, respectively.<sup>3</sup>.

### *The cost burden of asthma*

In 2022, Connecticut incurred \$116.7 million in acute care charges due to asthma as a primary diagnosis. Of that amount, \$65.9 million was for hospitalizations and \$50.8 million was for emergency department visits (charge data were lower in 2020 and 2021 than in previous years due to the COVID-19 pandemic, but they bounced back to pre-COVID-19 level in 2022). Of the \$116.7 million in health care charges, \$87.5 million (75%) was charged to public funds (Medicaid and Medicare)<sup>3</sup>.

## Putting on AIRS Program

The CDC's National Asthma Control Program (NACP) was created in 1999, and CAP received its first funding from NACP to build its asthma surveillance and epidemiology capacity in 2002. Through funding provided by CAP, the Putting on AIRS program was

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<sup>1</sup> Center for Disease Control and Prevention Asthma Data, Statistics, and Surveillance (retrieved July 2024). [https://www.cdc.gov/asthma/most\\_recent\\_national\\_asthma\\_data.htm](https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm)

<sup>2</sup> Data source: Connecticut Behavioral Risk Factor Surveillance System (retrieved July 2024). [https://portal.ct.gov/-/media/departments-and-agencies/dph/dph/hems/asthma/xls/adult\\_current\\_prevalence.xlsx](https://portal.ct.gov/-/media/departments-and-agencies/dph/dph/hems/asthma/xls/adult_current_prevalence.xlsx)

<sup>3</sup> Connecticut State Department of Public Health. (April 13, 2023). <https://portal.ct.gov/dph/health-education-management-surveillance/asthma/asthma-statistics> (retrieved September 9, 2024).

developed and piloted in 2005 by the Ledge Light Health District, a local health district serving towns in southeast Connecticut. In 2007, CAP expanded the home visiting program across Connecticut. The program was conducted through regional public health agencies and delivered to self-referred adults and families of children with asthma. The one-home visit asthma intervention was modified in 2015, to be aligned with the Community Preventive Services Task Force (CPSTF) and implemented in 2016.

The CPSTF combined with a review of the literature guided the modifications for the home-based asthma program to prioritize children with uncontrolled asthma, at risk for asthma exacerbations and high healthcare utilization. Putting on AIRS was re-designed to adopt a high intensity approach consistent with Krieger's<sup>4,5</sup> studies, through a three-home visiting model.

Putting on AIRS aims to improve an individual's asthma control by reducing environmental asthma triggers in the home and providing education for self-management of asthma symptoms. The program helps to empower families with knowledge and tools to effectively control asthma. Between 2016 and 2020, Putting on AIRS and its local partners reached more than 600 Connecticut families suffering from asthma. Health officials report the effort resulted in a decrease in asthma-related hospitalizations and emergency

## Putting on AIRS Historical Context

- **2005–2006:** Development of the intervention and pilot by Ledge Light Health District
- **2007–2009:** and **2009–2014:** Program expansion across Connecticut, delivered by local health departments. *A map of the program catchment areas is in the Appendix.*
- **2012–2014:** CAP evaluates the implementation and cost effectiveness of Putting on AIRS which led to program adjustments.
- **2016:** Putting on AIRS was revised from one home visit to three home visits.
- **2018:** Community health workers (CHWs) are introduced as a pilot in one local health district and integrated in 2019 at all program sites.
- **2019–2024:** A hybrid, virtual program model is introduced temporarily in **2020 to 2021** in the wake of the COVID-19 pandemic.
- **2022:** Social determinants of health are routinely assessed for all program participants.

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<sup>4</sup> Krieger J, Takaro TK, Allen C, Song L, Weaver M, Chai S, Dickey P. The Seattle-King County Health Homes Project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma. *Environ Health Perspect* 2002; 110 (Suppl. 2):311–322.

<sup>5</sup> Krieger JW, Takaro TK, Song L, Weaver M. The Seattle-King County Healthy Homes Project: a randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *Am J Public Health* 2005; 95(4):652–659.



department visits and fewer school absences<sup>6</sup>.

Program referrals are made through multiple sources and sent to the Putting on AIRS coordinator. Program eligibility criteria include:

- Diagnosis of asthma; confirmed severity status
- Poor asthma control as indicated by Asthma Control Test (score  $\leq 19$ ); or
- At least 1 emergency department visit or hospitalization or unscheduled medical visit in the last 6 months; or
- Nonadherence to Inhaled Corticosteroids; or
- Self-administered 3 rescue inhaler canisters in  $\leq 6$  months or
- Activity limitations due to asthma; or
- School Absences: missed  $\geq 2$  school days in the last year; or
- School nurse's office visits for asthma  $> 2$ /week; or
- Work Absenteeism: missed  $\geq 2$  workdays in the last year

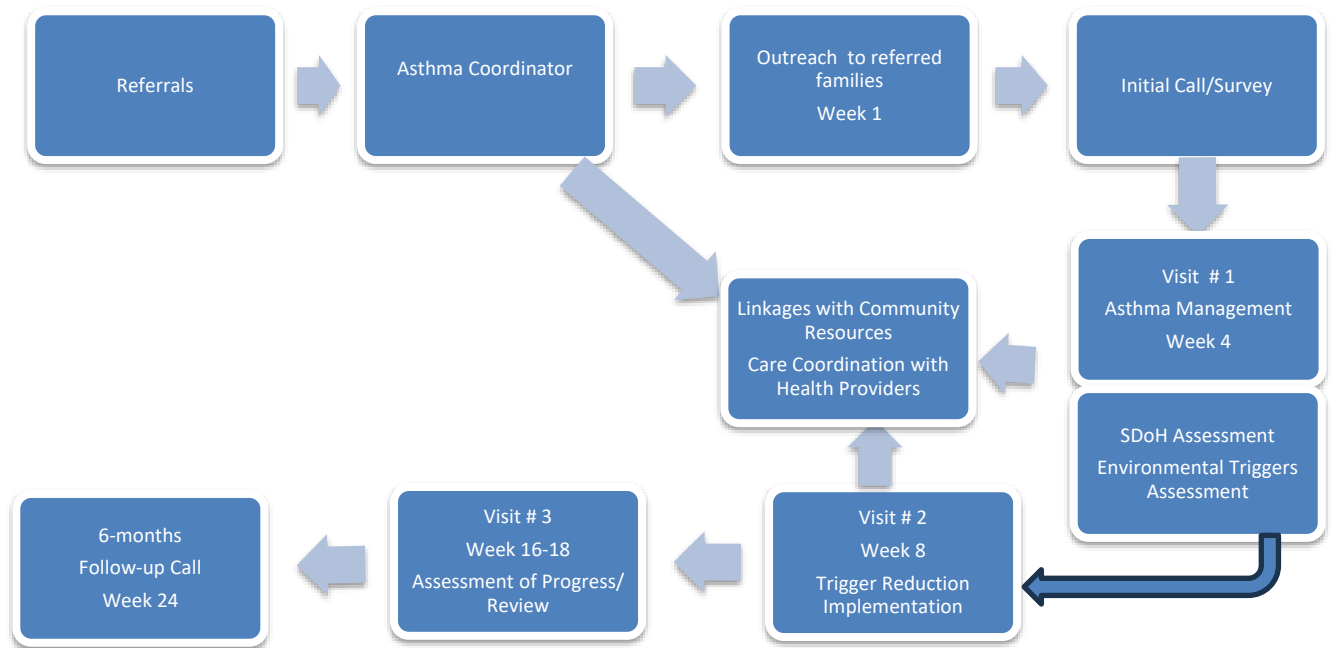
Putting on AIRS consists of three home visits during a six-month period and is carried out in several community regions in Connecticut. The Putting on AIRs team comprises an Asthma Education Specialist (Registered Nurse, Respiratory Therapist, or Certified Asthma Educator) and an Environmental Education Specialist. In August 2021, a Community Health Worker (CHW) became a part of the Putting on AIRS team, trained to conduct asthma home visits, assess social determinants of health (SDoH), and provide scheduling coordination and participant follow-up.

In addition to providing asthma management education, adults who smoke or parents of children with asthma who smoke are referred to a tobacco use cessation program and are tracked throughout their program participation. The CHW assesses participants' barriers to asthma management, identifies areas of need, and makes referrals to medical, community, and social services/resources.

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<sup>6</sup> Brockmeyer, J., Peng, J., Bournaki, M., & Angulo, R. (2024). Improved Outcomes among Clients of a Connecticut Asthma Home Visiting Program, Client referral period: September 2016– December 2020. Connecticut Department of Public Health, Chronic Diseases and Injury Prevention Section, Hartford, CT

**Figure 1: Putting on AIRS Protocol**



## Methods and Analysis

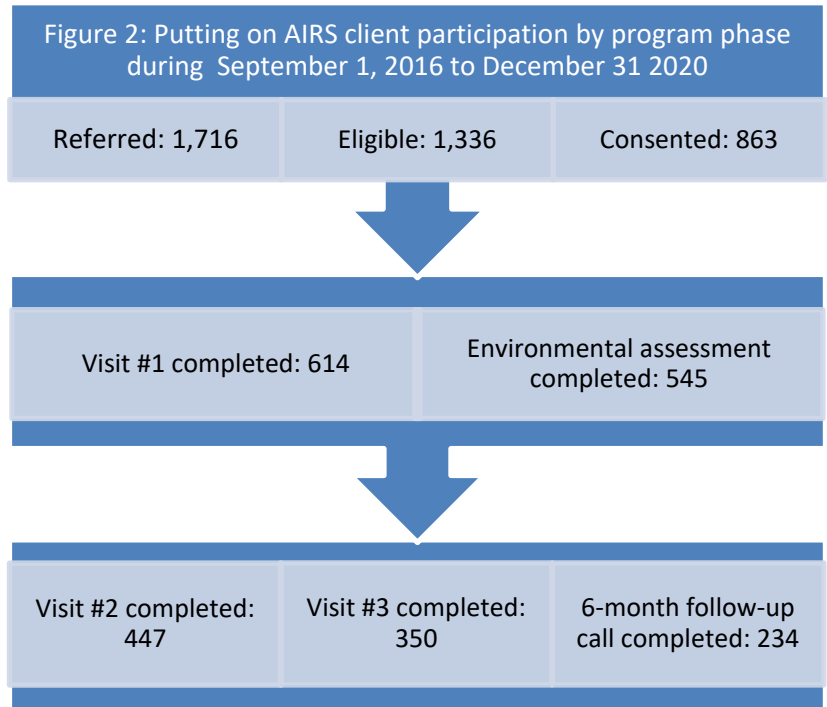
The Consultation Center Inc. was hired as an external evaluator to work with CAP to design the evaluation parameters to conduct an analysis of existing data (e.g., program records and hospital data) for the cost study. Initially, bi-weekly meetings were held with CAP to review Putting on AIRS participant data to select the parameters for the analysis and to review necessary data sources that could be used. Additional, as-needed meetings with CAP and the CDC evaluation technical assistance partner and economic evaluation specialist were critical to guiding the evaluation design and analysis.

The data analyzed for this analysis include:

- Putting on AIRS contractor financial reports submitted between September 2016 and December 2020
- Putting on AIRS program data including service interactions between program staff and participants and self-reported data from participants about their asthma-related medical visits, and time off work due to uncontrolled asthma
- Connecticut hospital and emergency room charge data for asthma-related visits
- Medical doctor charge data

*Study Design*

Figure 2 provides the number of participant interactions per program phase. The objective of this evaluation was to assess the cost and cost savings associated with the implementation of the Putting on AIRS program between September 2016 and December 2020. This timeframe was selected to allow time for hospital and ED-related data to become available for analysis, and due to program model changes that occurred during the COVID-19 pandemic. Specifically, Putting on AIRS staff offered a hybrid program model during the pandemic that offered video conferencing (including virtual environmental inspections) versus in-person visits to ensure the safety of participants and staff.



*Participant Demographics*

Table 1 provides participant demographics between September 2016 to December 2020.

**Table 1: Putting on AIRS Participant Demographics**

Characteristic	Category	#	%	By when information is collected
Age Group (years)	0 -4	503	29.4%	Program referral
	5-9	527	30.8%	
	10-17	413	24.1%	
	18 and older	268	15.7%	
	Missing/not collected	5		
Sex	Male	722	50.5%	Visit #1
	Female	701	49.0%	
	Other identity	7	0.5%	
	Missing/not collected	286		

**Table 1 (cont'd): Putting on AIRS Participant Demographics**

Characteristic	Category	#	%	By when information is collected
Race/ethnicity	White, non-Hispanic	203	19.0%	Visit #1
	Black, non-Hispanic	290	27.2%	
	Hispanic	550	51.6%	
	All other races, non-Hispanic	23	2.2%	
	Missing/not collected	650		
Language(s) spoken	English	923	79.3%	Visit #1
	Spanish	90	7.7%	
	English & Spanish	143	12.3%	
	Other language	8	0.7%	
	Missing/not collected	552		
Primary caregiver formal education	Less than high school	149	12.1%	Visit #1
	High school or GED	295	84.0%	
	Some post high school	228	1.3%	
	College graduate	87	2.1%	
	Missing/not collected	957	0.5%	
Type of health insurance	Private	148	12.1%	Visit #1
	HUSKY/Medicaid	1024	84.0%	
	Medicare	16	1.3%	
	Other	25	2.1%	
	None	6	0.5%	
	Missing/not collected	497		
Rent or own home	Homeowner	129	23.3%	Visit #1
	Tenant	425	76.7%	
	Missing/not collected	1162		

***Cost savings analysis approach***

To calculate potential cost savings from the program, we analyzed self-reported data about asthma-related hospitalizations, emergency room visits, medical visits, and caregiver time off from work due to an asthma-related event collected at intake and follow-up from a subset of 287 participants who completed the program. The goal was to calculate the total savings experienced by participants in relation to the costs incurred from these services. By adopting this approach, we aim to provide an understanding of the financial impact of the program, highlighting not only the direct healthcare-related savings but also the broader economic benefits associated with improved health outcomes and reduced caregiver absenteeism.

Asthma-related emergency, hospitalizations, and medical doctor visits charge information was provided by CAP<sup>7</sup>. A charge conversion of 32% was used to estimate hospital and emergency room costs versus charges for the analysis<sup>8</sup>. The rate of pay for caregiver workdays absent was based on a literature search and consultation with the CDC Economic technical advisor<sup>9</sup>. We recognize that this source is outdated (based on information collected between 2002 and 2007) and is a limitation of the analysis.

The following cost-savings indicators were used for the analysis.

- Emergency Room Visits<sup>5</sup>
  - Average charge for children ages 0 to 17 from 2019 to 2021 (\$2,586 per visit).
- Hospitalizations<sup>5</sup>
  - Average charge for children ages 0 to 17 from 2019 to 2021 (\$21,877 per visit).
- Medical Doctor Visits<sup>5</sup>
  - Average payment cost from Medicaid, Medicare, private insurance, and out-of-pocket expenses from 2011 to 2015 (\$841 per visit).
- Caregiver Workdays Absent<sup>7</sup>
  - Average daily wage of workers with asthma from 2002 to 2007 (\$301 per day).

## Results

Contractor financial reports provided to CAP for reimbursement were compared with information logged in the Putting on AIRS database by each contractor to estimate the time and cost of delivering each program component (Table 2). A 15% Administrative cost was added to the program total to account for overhead, onboarding, and other infrastructure costs that were not captured in the contractor reports. As shown in Table

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<sup>7</sup> Connecticut State Department of Public Health. (2023). Asthma Charges Annual Categories.

<https://portal.ct.gov/dph/health-education-management--surveillance/asthma/asthma-statistics>

<sup>8</sup> Charge data is provided for ER and Hospitalization drivers. A charge conversion of 32% to estimate costs based on this reference was used: [https://portal.ct.gov//media/OHS/ohca/HospitalFillings/2022/FY2021\\_RCC.pdf](https://portal.ct.gov//media/OHS/ohca/HospitalFillings/2022/FY2021_RCC.pdf)

<sup>9</sup> Barnett, S. B., & Nurmagambetov, T. A. (2011). Costs of asthma in the United States: 2002–2007. *Journal of Allergy and Clinical Immunology*, 127(1), 145–152. <https://doi.org/10.1016/j.jaci.2010.10.020>

2, the total program cost for Putting on AIRS between September 2016 to December 2020 was \$408,923.

**Table 2: Putting on AIRS Program Costs for the Participant Sample**

Program Component	Time to Complete Task	Hourly Rate/Cost	Frequency Count	Estimated Program Cost
Referral	120 minutes	\$30/hr	1716	\$102,960
Eligibility/Consenting Process	120 minutes	\$30/hr	1336	\$80,160
Admin Time for Scheduling Visit 1	120 minutes	\$30/hr	614	\$36,840
Visit 1	90 minutes	\$40/hr	614	\$36,840
Environmental Assessment	30 minutes	\$50/hr	545	\$13,625
Prep Time for Visit 2	120 minutes	\$30/hr	447	\$26,820
Visit 2	90 minutes	\$40/hr	447	\$26,820
Prep Time for Visit 3	60 minutes	\$30/hr	350	\$10,500
Visit 3	60 minutes	\$40/hr	350	\$14,000
6-Month Follow-up Call	60 minutes	\$30/hr	234	\$7,020
Total				\$355,585
Administrative Costs <sup>10</sup> (15% of total)				\$53,338
<b>Total Program Cost</b>				<b>\$408,923</b>

### *Cost savings*

Analysis of asthma-related healthcare utilization reveals significant savings across various categories. Progress in each category was based on the change in self-reported counts of healthcare visits and missed caretaker workdays from the six months prior to program referral to the six months preceding the six-month follow-up call. Results are based only on clients who provided data at both timepoints. As shown in Table 3, emergency room visits exhibit a reduction of 282 asthma-related ED visits leading to a cost savings of \$233,361. Similarly, hospitalizations saw a positive trend, with 117 fewer hospitalizations resulting in a total savings of \$819,075. Asthma-related medical doctor visits also declined during this period, with 606 fewer asthma-related visits equaling a savings of \$509,646. Lastly, reports of caregiver workdays absent due to an asthma-related event decreased between program intake and follow-up to 198 fewer missed workdays equating to \$59,598 in wage savings.

<sup>10</sup> Administrative costs include a portion of overhead, office and program supplies, travel, technology, and training.

**Table 3: Cost Savings Indicators and Analysis**

Cost Drivers, Self-reported	Pre-Post Program Change	Monetary Value	Total Savings in Charges	Total Cost Savings
Emergency Room Visits	282 fewer visits	\$2,586 per visit charge <sup>11</sup>	\$729,252	\$233,361 savings
Hospitalizations	117 fewer visits	\$21,877 average charge <sup>12</sup>	\$2,559,609	\$819,075 savings
Medical Doctor Visits	606 fewer visits	\$841 per visit <sup>13</sup>	N/A <sup>14</sup>	\$509,646 savings
Caregiver Days Absent <sup>15</sup>	198 fewer days	\$301 per day <sup>16</sup>	N/A <sup>11</sup>	\$59,598 savings
<b>Total Health Cost Savings</b>				<b>\$1,621,680 savings</b>

Over the course of the program, participants experienced 1,005 fewer asthma-related visits to emergency rooms, hospitals, and medical doctors. Collectively, more than \$1.6 million in health cost savings were reported. These outcomes highlight the potential economic benefits of effective asthma management, showcasing a reduction in both healthcare utilization and associated financial burden.

#### *Return on Investment*

To calculate the return on investment, we subtracted program costs (\$408,923) from health cost savings (\$1,621,680) and divided by total program costs (\$408,923) revealing a 2.97 return on investment or a 300% return<sup>17</sup>.

## Discussion

The Putting on AIRS program demonstrates a reduction in asthma-related medical visits and a related health-cost savings from these services. A companion study of

<sup>11</sup> Charge data is provided for ER and Hospitalization drivers. A charge conversion of 32% to estimate costs based on this reference was used: [https://portal.ct.gov//media/OHS/ohca/HospitalFillings/2022/FY2021\\_RCC.pdf](https://portal.ct.gov//media/OHS/ohca/HospitalFillings/2022/FY2021_RCC.pdf)

<sup>12</sup> Connecticut State Department of Public Health. (2023). Asthma Charges Annual Categories.

<sup>13</sup> Syamlal, G., Bhattacharya, A., & Dodd, K. E. (2020). Medical expenditures attributed to asthma and chronic obstructive pulmonary disease among workers — United States, 2011–2015. *MMWR. Morbidity and Mortality Weekly Report*, 69(26), 809–814. <https://doi.org/10.15585/mmwr.mm6926a1>

<sup>14</sup> Charge conversion not applicable for this cost driver

<sup>15</sup> Connecticut State Department of Public Health. (2023). Putting On AIRS dataset.

<sup>16</sup> Barnett, S. B., & Nurmagambetov, T. A. (2011). Costs of asthma in the United States: 2002–2007. *Journal of Allergy and Clinical Immunology*, 127(1), 145–152. <https://doi.org/10.1016/j.jaci.2010.10.020>

<sup>17</sup> Turner HC, Hori Y, Revill P, Rattanavipapong W, Arai K, Nonvignon J, Jit M, Teerawattananon Y. Analyses of the return on investment of public health interventions: a scoping review and recommendations for future studies. *BMJ Glob Health*. 2023 Aug;8(8): e012798. doi: 10.1136/bmjgh-2023-012798. PMID: 37648275; PMCID: PMC10471881.

client outcomes conducted by CAP from the same timeframe as this cost study (September 2016–December 2020) with 287 individuals that met eligibility criteria, consented to participate, and completed the three–visit series revealed the following, statistically significant improved outcomes<sup>18</sup>:

- Based on self–reported data, clients completing the Putting on AIRS program experienced significant reductions in self–reported asthma ED visits, total ED visits plus hospitalizations, unscheduled medical appointments, missed school days, and caretaker absences from work.
- Clients also experienced significant improvements in self–reported adherence to asthma medication, self–administration skills, and asthma control status.
- In addition to self–reported data, clients were matched to their hospital discharge records to obtain their hospital–reported hospitalizations and ED visits. The result showed clients completing the Putting on AIRS program experienced significant decreases in hospital–reported ED visits and in hospital–reported total ED visits plus hospitalizations.
- When comparing reductions in hospital–reported ED visits among clients completing the Putting on AIRS program to reductions experienced by those who were referred to the program but completed zero visits, it was found that among individuals with a history of one asthma ED visit in the 12 months prior to referral, those who completed the Putting on AIRS program experienced a significantly greater reduction in asthma ED visits than those who were referred–only. The same was not true for those with a history of more than one asthma ED visit in the 12 months prior.

Additionally, the study found significant decreases in hospital–reported ED visits and total ED visits plus hospitalizations for individuals referred to Putting on AIRS program who did not complete any home visits.

## Limitations

The following limitations of the cost study are noted:

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<sup>18</sup> Brockmeyer, J., Peng, J., Bournaki, M., & Angulo, R. (2024). Improved Outcomes among Clients of a Connecticut Asthma Home Visiting Program, Client referral period: September 2016–December 2020. Connecticut Department of Public Health, Chronic Diseases and Injury Prevention Section, Hartford, CT.



- Reliance on self-reported data from participants and contractors, which may introduce biases or inaccuracies.
- Cost savings are likely under-reported due to an inability to quantify other medical services (e.g., emergency medical services and transportation) and quality of life benefits (e.g., productivity, physical wellbeing, enhanced school performance and attendance).
- Limited up-to-date published resources pertaining to economic cost indicators (e.g., caregiver days absent from work, medical expenditures).
- The contractor financial report templates were developed prior to the cost study and did not directly map to the cost study reporting needs.
- Incongruencies in reporting administrative costs from various contractors, which resulted in applying a 15% administrative cost estimate across all contractors.

## Recommendations

To reduce the risk of biases and inaccuracies when collecting self-report information, it is recommended to use other data collection sources, such as medical health records or surveying more than one family member to validate self-reported information. It may be beneficial to all families of children with asthma to use a memory aid, such as a diary, to track asthma-related episodes and concerns. Such a tool may facilitate better recall of information when discussing with health care providers and other health professionals.

Improvements in the data collection process would benefit any future assessment of cost savings related to program participation. Consistent cost documentation of various line items, as clients complete program components, is recommended for more accurate cost-benefit analysis in the future. The use of a standard protocol and uniform data collection instruments for cost documentation would facilitate data consistency across program sites.

## Conclusion

Current findings related to cost savings among program participants support the benefits of the CT Asthma Home Visiting program, Putting on AIRS. As a multi-

component intervention designed for children with asthma at moderate to high risk of adverse events, the Putting on AIRS is considered an ‘intensive outpatient’ program<sup>19</sup> that is cost effective. Findings related to cost savings among program participants may be leveraged to promote the benefits of this program for increased program funding, such as promoting Putting on AIRS to the Connecticut Department of Social Services for the purpose of Medicaid reimbursement; thereby improving the expansion of accessible statewide services and ensuring program sustainability.

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<sup>19</sup> Hsu, J.M, Wilhelm, N. Lewis L., and Herman, E. Economic Evidence for US Asthma Self-Management Education and Home-based Interventions. *J Allergy Clin Immunol Pract* (2016); 4(6): 1123–1134.e27. doi:10.1016/j.jaip.2016.05.012.

# Appendix

## Putting on AIRS Contractor Catchment Areas

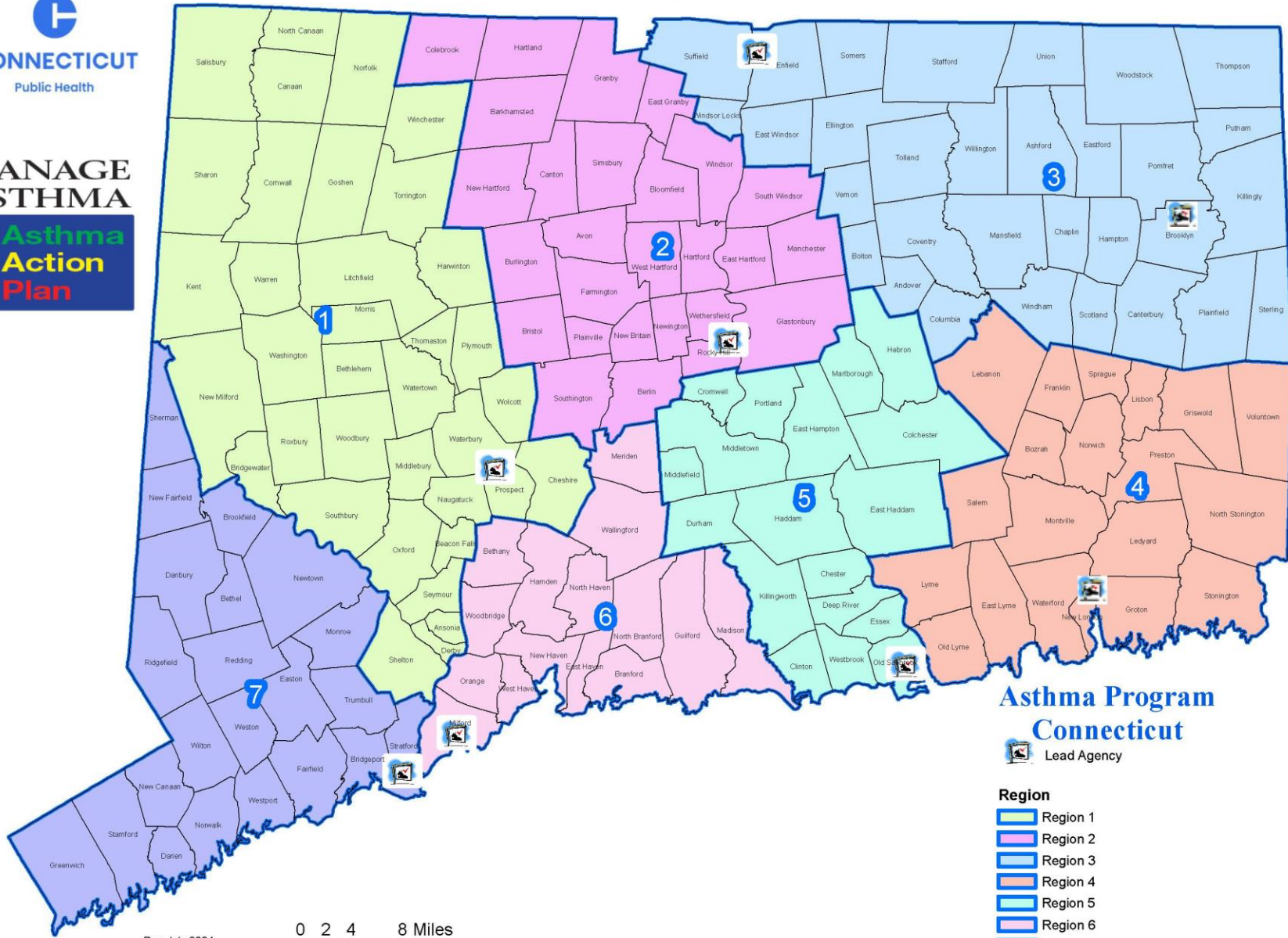
# Connecticut Asthma Program Putting on Airs (POA) Regions

## Connecticut Department of Public Health



**MANAGE  
ASTHMA**

- Asthma
- Action
- Plan



**Asthma Program  
Connecticut**  
Lead Agency

- Region**
- Region 1
  - Region 2
  - Region 3
  - Region 4
  - Region 5
  - Region 6
  - Region 7



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