

Contra Costa Asthma Initiative

A business plan for a comprehensive home-based asthma program



“

Our communities don't get the attention we need. I feel most healthcare services are negligent towards us. I'm thankful that our communities are being targeted. It's making a difference for my family and is very helpful.”

- Contra Costa Health Plan asthma pilot participant

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Executive Summary

Problem Statement: 300,000 Contra Costa residents live in a census tract that ranks in the 95th percentile or higher of asthma Emergency Department (ED) rates statewide. This is the highest number of people in any county in the state and the fourth highest by percent of County residents in the state. An estimated 4,950 people visit the ED for asthma each year in the County and they disproportionately are of lower socio-economic status and African-American than the general population. Asthma exacerbations are largely avoidable, but significant portions of the federally recommended asthma care guidelines (home-based education and remediation of asthma triggers) are not traditionally covered by Medicaid or included in traditional clinical care.

Proposal: The initiative expands upon existing asthma home visiting efforts in two ways: 1) by incorporating home assessment and remediation service provision into current program efforts, and 2) developing operational proficiency in a home-based delivery model, which can serve as a blueprint for securing sustainable funding to address social determinants of health from the healthcare, housing, and energy sectors. The initial phase of the initiative targets 50 high-risk members (adults and children) on the Contra Costa Health Plan (CCHP) over one year with a coordinated home-based delivery model that supplements traditional clinical care. Additional phases may include a) expansion of the target population to include low- and middle-income residents (i.e. those not on CCHP) through partnerships with BayREN and other insurers or b) expansion of services to include additional healthy home measures for other health issues (e.g. COPD, trip/falls). The initial phase consists of the following services and impacts:

Program Component	Service Partner	Potential Funding Source (Budget for 50 enrollees)
Home visits for asthma education and medication management, including consumer supplies to address asthma triggers (e.g. green cleaning supplies).	Contra Costa Health Plan	State Asthma Fund \$55,000 - \$85,000
Assessment and remediation of asthma triggers in the patients' homes (e.g. mold remediation, carpet removal/cleaning, ventilation)	<i>Single-family:</i> County Weatherization <i>Multi-family:</i> Association for Energy Affordability (AEA)	CDBG supplemented with foundations \$77,500 - \$135,000
Energy efficiency and weatherization services	BayREN, MCE, County Weatherization	Leverages existing funding sources
Program support functions , such as database, tablets, evaluation, assessor training, outreach time	TBD	State Asthma Fund + foundations \$27,500 - \$55,000
Total		\$160,000 - \$275,000 (\$3,200 - \$5,500 per member)

Direct Impacts (3-yr estimates of serving 50 members)	Long-term Impacts
<ul style="list-style-type: none"> • \$175,000 savings to CCHP (\$3,500 per member) • 140 fewer ED visits and its associated reduction in overcrowding (2.5 per member) • 70 fewer ambulance trips and decrease in associated wait time • 20% increase in Asthma Medication Ratio (AMR) from .5 to .6 • 20% Decrease in missed school and work days 	<ul style="list-style-type: none"> • Development of coordinated health, energy, and housing delivery model that is a blueprint for: <ul style="list-style-type: none"> ○ Addressing root of housing-related health inequities ○ Blueprint for sustainable health insurer funding of services ○ Leveraging energy efficiency expertise and funds

Problem Statement

David¹, a man in his late fifties with respiratory failure, congestive heart failure, renal failure, and a history of homelessness, was recently housed in an apartment in Antioch. Although he now had a roof over his head, the apartment lacked air conditioning, the windows had been painted shut, and the apartment was infested with rodents. With these living conditions, David was frequently going in and out of the emergency room for breathing problems.

The proposed asthma program is designed to supplement existing primary care services by providing a home-based asthma program with visiting health workers (either community health workers or nurses) to engage patients with personalized, in-home asthma education and remediation of their underlying asthma triggers. Evidence shows that while medication and clinical care can help mitigate David’s respiratory challenges, until the temperature and rodent hazards in his home are fixed, he will continue to struggle.

In David’s case, his Public Health Nurse, Veronica, connected him to County Weatherization services through a pilot program to develop referral processes between the two programs. The Weatherization program provided him with an air conditioning unit, opened his windows, and talked to his landlord about the rodent challenge, in addition to working with him on asthma self-management. He no longer needed to be on oxygen 24/7. David felt better, “I’m getting a little stronger. I just started back walking three days ago.”

There are an estimated 4,950 people in Contra Costa County who, like David, visit the Emergency Department each year for asthma². Asthma is one of the most common chronic diseases affecting the U.S. population, with one in 13 individuals having ever been told they had asthma³. As of 2017, Contra Costa ranked in the top 25% of California counties in terms of active and lifetime asthma prevalence, asthma ED visits, and hospitalization admits⁴. Within Contra Costa, however, this is even more concentrated by geography, race, and income. 300,000 Contra Costa residents live in a census tract that ranks in the 95th percentile or higher of asthma ED rates statewide (Figure 1), the highest number of people in any county in the state and the fourth highest by percent of County residents in the state (after Kings, Imperial, and Merced)⁵. Additionally, African-Americans are 3 times as likely to visit the ED for asthma compared to the general population and CCHP members are 2 times as likely relative to the general County population (Table 1).

Table 1. Annual Asthma ED Visit Rates by Race/Ethnicity

Avg. number ED visits per 100 people in single year (expressed as percentage)

	National (2016)	California (2017)	Contra Costa County (2017)	CCHP Medi-Cal ('18-'19)
African-Americans	1.6%	1.7%	2.2%	3.2%
Latino/Hispanic	0.8%	0.5%	0.7%	1.4%
White	0.4%	0.5%	0.4%	0.9%
Asian/Pacific Islander	-	0.2%	0.3%	0.9%
Other	-	0.8%	0.7%	0.7%
Total	0.6%	0.5%	0.6%	1.3%

*Data Sources: National (CDC); California & County (Tracking California); CCHP (CCHP internal, RMC & CPN Networks)
CCHP: Contra Costa Health Plan; ED: Emergency Department
See Appendix A for further methodology*

¹ Name has been changed. Read more at <http://www.rampasthma.org/D:Web%20Siteswww.rampasthma.org/wp-content/uploads/2018/12/Energy-Efficiency-and-Health-Guide-for-Public-Health-and-Health-Care-Professionals.pdf>

² GHHI estimate based on extrapolation from CCHP, OSHPD, and American Census Data. See Appendix A for methodology

³ See https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm

⁴ Prevalence from California Breathing via CHIS; utilization from Tracking California via OSHPD

⁵ Cal Enviro Screen. See supplementary excel files and Appendix A for methodology

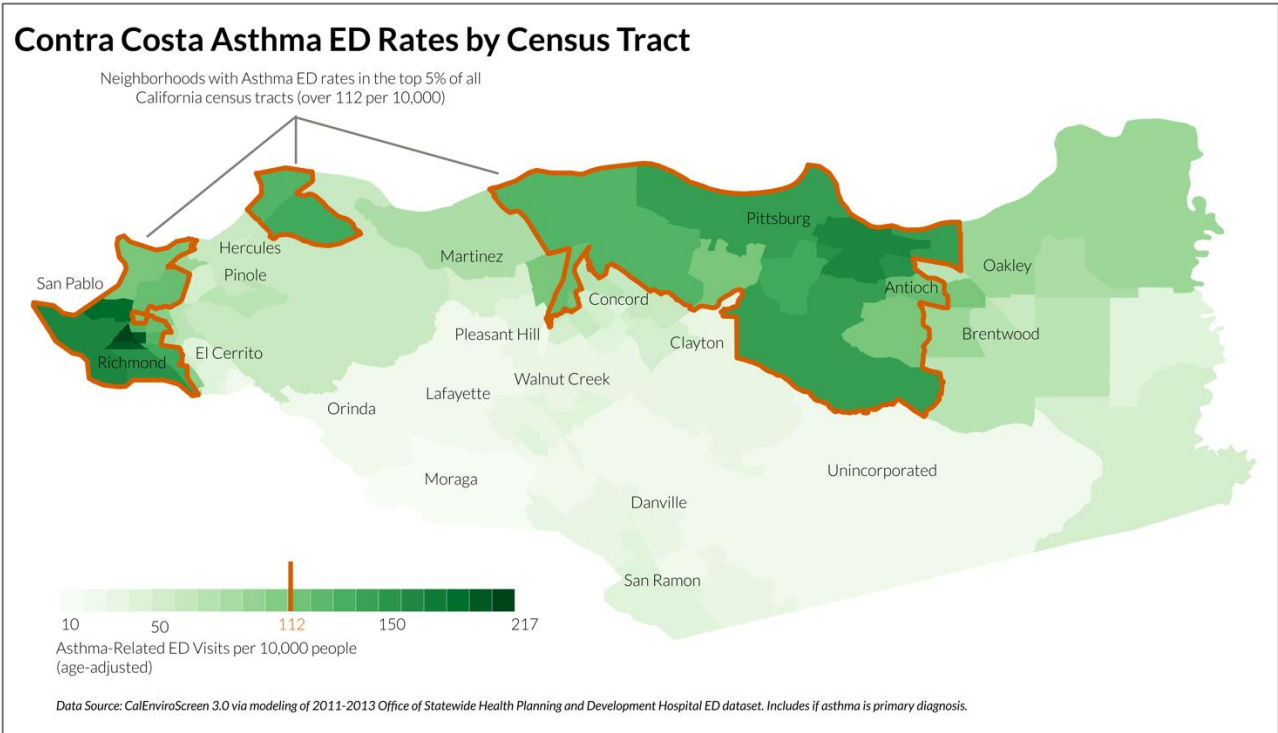


Figure 1

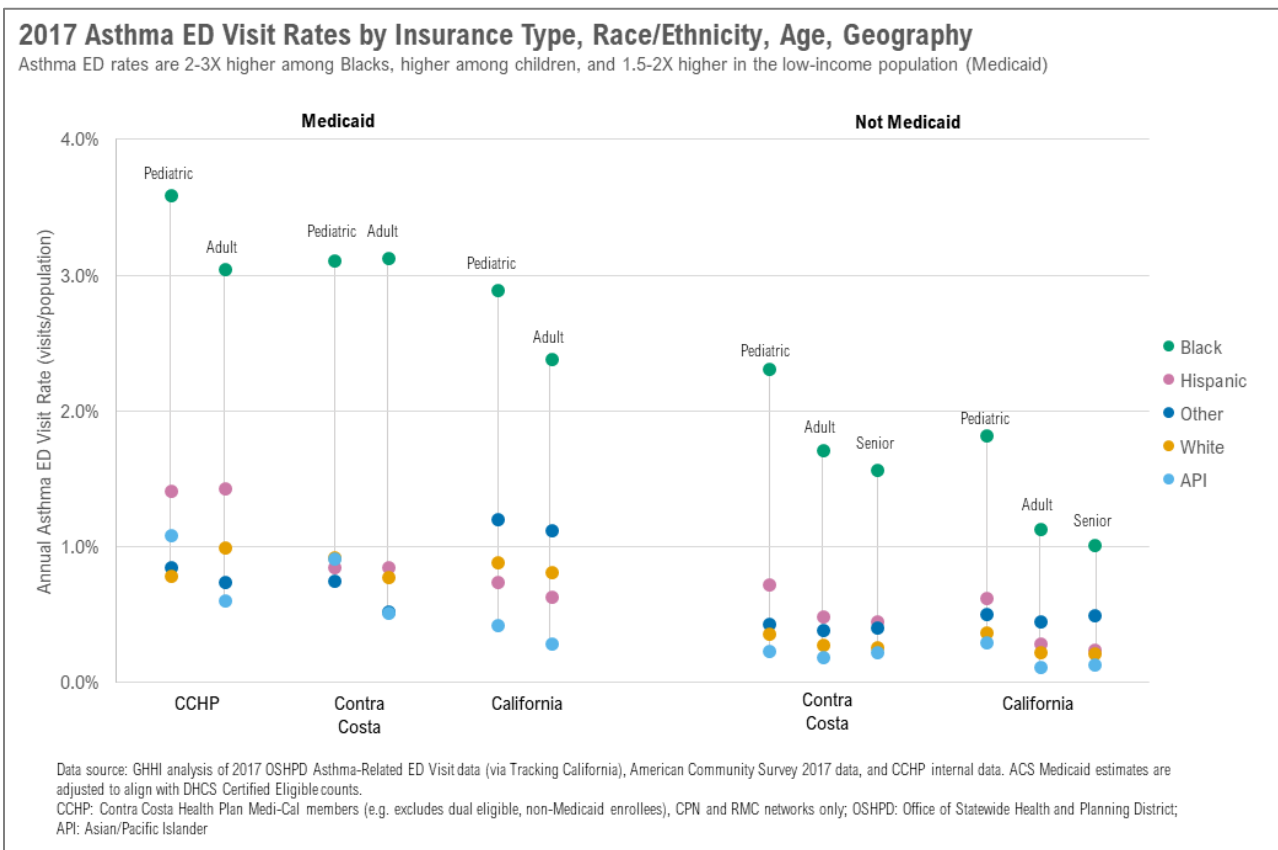
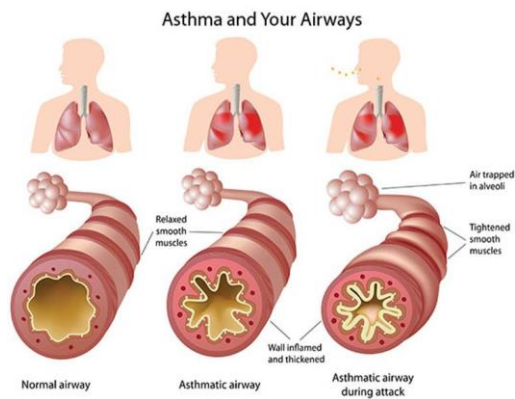


Figure 2

Asthma typically develops by age 7, although it may develop later in life, and is caused by both environmental (physical, psychosocial, and microbial) and genetic factors. Once somebody has developed asthma, it remains present whether or not they have symptoms. While there is limited understanding of how to prevent the development of asthma, there is extensive evidence of medical and community-based care that can help patients manage their asthma and prevent asthma exacerbations.



The development of asthma increases the sensitivity of an individual's airways, which then are more prone to becoming irritated and inflamed when exposed to asthma triggers. This exposure then causes the airways to swell and develop mucous, constricting airflow (Figure 3). While considerable investment has been made in developing asthma medications, researchers have estimated that eliminating home-based asthma triggers, if causally associated, would reduce up to 44% of asthma diagnoses among children⁶ and adolescents.⁷

Figure 3

A 2015 update to the Institute of Medicine's literature review of asthma triggers found causal evidence for two types of home-based asthma triggers, allergens and dampness-related agents, and suggestive evidence for a third, irritants⁸:

- **Allergens** (e.g. dust mites, cats, cockroaches, outdoor fungi, rodents) These are often correlated with moisture, but can also exist in bedding, carpets, HVAC systems, and trash.
- **Irritants** (e.g. tobacco smoke, NO_x, VOCs). NO₂ is a combustion byproduct. Combustion appliances include gas stoves, space heaters, poorly vented furnaces, and fireplaces.
- **Dampness/Moisture** Damp conditions are favorable for many biological allergens, such as dust mites, bacteria, mold, and pests, to grow and thrive. The chemicals released from damp conditions or the biologic activity may also trigger asthma. Home dampness is the result of water infiltration (leaks in walls, roof, windows) and sub-optimal humidity or condensation from poor temperature control and ventilation.

⁶ Lanphear, B. P., Aligne, C. A., Auinger, P., Weitzman, M., & Byrd, R. S. (2001). Residential exposures associated with asthma in US children. *Pediatrics*, 107(3), 505-511.

⁷ Lanphear, B. P., Kahn, R. S., Berger, O., Auinger, P., Bortnick, S. M., & Nahhas, R. W. (2001). Contribution of residential exposures to asthma in US children and adolescents. *Pediatrics*, 107(6), e98-e98.

⁸ Kanchnongkittiphon, W., Mendell, M. J., Gaffin, J. M., Wang, G., & Phipatanakul, W. (2014). Indoor environmental exposures and exacerbation of asthma: an update to the 2000 review by the Institute of Medicine. *Environmental health perspectives*, 123(1), 6-20.

Target Population

The first phase of the initiative will occur over one year and target approximately 50 Contra Costa Health Plan members with poorly controlled asthma, as identified via medical records or health professional referral. While there is no age or geographic eligibility restriction, the program may want to target outreach to areas or physicians with higher concentrations of eligible members. The number 50 was selected based on expectation of a full case load for a health worker and may be adjusted depending on future staffing decisions.

Estimates of Asthma ED Visits in Contra Costa County

Of the 1.1M Contra Costa residents, an estimated 4,950 visit the ED each year for asthma. This disproportionately affects those on Medi-Cal or under the 200% Federal Poverty Line, who comprise an estimated 56% of all asthma ED visits despite being only 28% of the total population (Table 2)

Table 2. Distribution of Contra Costa Residents with Asthma ED Visits By Income (2017)

Population rounded to thousands and people with asthma ED visit rounded to tens

	Lower Income <small><200% FPL or Medi-Cal</small>	Middle Income <small>>200% FPL & <\$125,000 (hh)</small>	Higher Income <small>>\$125,000 (hh)</small>	Total
Total Population	316,000	375,000	457,000	1,148,000
% of Total Population	28%	33%	40%	100%
# People with Asthma ED Visit	2,740	1,110	1,050	4,900
% Population w/ Asthma ED Visit	0.9%	0.3%	0.2%	0.4%
% of Total People w/ Asthma ED Visit	56%	23%	21%	100%

*Data Sources: GHH analysis of OSHPD, DHCS, ACS, and CCHP data
FPL: Federal Poverty Line; (hh): household income; ED: Emergency Department
See Appendix A for further methodological details*

The initial phase of this initiative will target a subset of the Lower Income group – Contra Costa Health Plan Medi-Cal members in the Regional Medical Center (RMC) or Community Provider Network (CPN), which represent approximately 40% of this group both by population (120,000 members) and people with an asthma ED Visit (1,200 members). The remainder of this Lower Income Group reflects additional CCHP members (e.g. dual eligible, those in the Kaiser network), Anthem Blue Cross members, Medi-Cal members who are served directly by the state, and the uninsured. These non CCHP Medi-Cal groups can be served through expansion of this initial phase.

Additionally, this initiative can expand to serve the Middle-Income population through partnership with BayREN, a regional energy efficiency initiative that targets those with a household income under \$125,000 but don't qualify for Weatherization and other income-eligible energy efficiency programs (typically under 200% FPL).

Finally, this initiative can expand its scope of intervention services to provide a comprehensive healthy homes program and to address other housing-related health conditions, such as COPD, trip/fall hazards, and those at risk of thermal stress (e.g. heat vulnerability). In terms of services,

the initiative is currently scoped to prioritize asthma-related home modifications (see later sections for more details), but the intended goal is to eventually identify funding to provide a comprehensive healthy homes program – addressing hazards like lead paint, asbestos, injury hazards.

Characteristics of the Target Population

CCHP members with poorly controlled asthma differ from the general population in several ways, each of which is described below along with how the program is designed to address the specific characteristics.

Housing Tenure

CCHP members are more likely to rent and live in multi-family buildings than others in the County. Based on ACS estimates, over 50% rent, with 20% living in apartment buildings (Table 3). The program addresses this in a few ways:

- The home assessment and remediation partners (see later section) are very experienced in running multi-family energy efficiency and weatherization programs. They are also able to offer the building owner a free energy assessment and significant rebates which may help to incentive the owner to allow improvements in the patients’ units.
- The program identified several multi-family buildings in the County with multiple tenants with asthma. This both a) helps identify buildings that likely have the biggest need for improvements and b) increases the program efficiency by serving multiple patients at a single address.
- The County Weatherization program is experienced at working with landlords to serve single-family renters.

Table 3. Contra Costa County Housing Type by Income Category (2017)

% is of individuals, not of housing units

	Lower Income <200% FPL or Medi-Cal	Middle Income >200% FPL & <\$125,000 (hh)	Higher Income >\$125,000 (hh)
% SF Owner-Occupied	40%	62%	85%
% SF Rental	32%	21%	10%
% MF Rental	21%	14%	4%
% Other	7%	3%	1%
Total	100%	100%	100%

*Data Source: GHFI analysis of 2017 American Community Survey estimates
FPL: Federal Poverty Line; (hh): household income; SF: single-family; MF: multi-family
See Appendix A for further methodological notes*

Demographics

This initiative has the opportunity to address racial health inequities, as CCHP members with asthma are more likely to be African-American and female than the general population. Meanwhile, they are similar to the general population in that roughly a quarter are primarily Spanish speaking (Table 4). The initiative addresses this primarily through the use of bilingual service providers who bring deep understanding of Hispanic culture.

Table 4. Demographics of CCHP Medi-Cal Members ('18-'19) Relative to County Population (2017)

CCHP Medi-Cal members participating in either CPN or RMC network (excludes Kaiser) w/ at least one asthma-related claim in given year

	CCHP Members w/ Asthma Claim			County-wide Pop.	
	Adults	Kids	Total	Medicaid	All
People	2,326	1,847	4,173	273,882	1,147,575
Race/Ethnicity					
% Black	23%	19%	21%	13%	8%
% Hispanic	34%	54%	43%	42%	26%
% API	9%	7%	8%	13%	17%
% Other	10%	11%	10%	7%	5%
% White	24%	10%	18%	24%	44%
Total	100%	100%	100%	100%	100%
Gender					
Male	30%	58%	42%	47%	49%
Female	70%	42%	58%	53%	51%
Total	100%	100%	100%	100%	100%
Primary Language					
% Spanish	15%	36%	24%	38%	23%
% English	82%	61%	73%	39%	54%
% Other	3%	3%	3%	20%	22%
Total	100%	100%	100%	100%	100%

*Data Source: GHFI analysis of CCHP, ACS, DHCS data
See Appendix A for further methodology details*

Healthcare Utilization and Costs

Of the 4,170 CCHP Medi-Cal members (RMC & CPN Networks only) with an asthma claim, 388 members had at least one inpatient admission for asthma, totaling 477 inpatient admissions (1.2 per member). 1,220 members visited the ED for asthma, totaling 1,631 visits (1.3 per member). The 572 members with multiple asthma-related ED visits or 1+ asthma inpatient admit from April 2018 – April 2019 were responsible for nearly 60% of all asthma-related hospitalizations or ED visits (Figure 4).

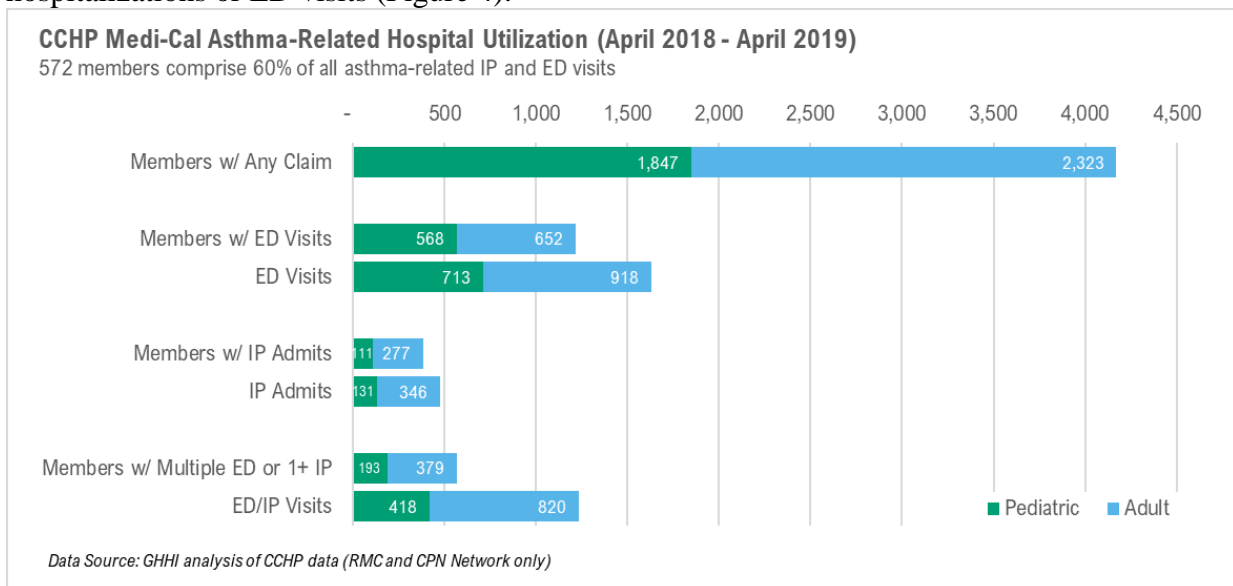


Figure 4

Primary Care Network

Approximately 80% of the identified CCHP members with a recent asthma claim receive their primary care through the RMC (Regional Medical Center) network, a County-provided service (Table 5). This calculation excludes those in the Kaiser network. A key finding from CCHP's initial asthma home visiting pilot was that partnering with physicians for referrals of high-risk asthma patients was far more effective at recruitment than cold-calling based upon medical utilization data. Targeting physicians at the highest utilized clinics will build upon this.

Table 5. Assigned Primary Care Provider for CCHP Members w/ Asthma ('18 - '19)

CCHP Medi-Cal members participating in either CPN or RMC network (excludes Kaiser) w/ at least one asthma-related claim in given year

Primary Care Provider	Count	% of total
CPN (Community Provider Network) Network	863	21%
Independent Clinics	549	13%
Lifelong	173	4%
La Clinica	141	3%
RMC (Regional Medical Center) Network	3307	79%
Pittsburg Health Center	891	21%
West County Health Center	575	14%
Antioch Health Center	449	11%
Concord Health Center	430	10%
Brentwood Health Center	356	9%
Miller Wellness Center	205	5%
Martinez Health Center	204	5%
North Richmond Health Center	99	2%
Bay Point Health Center	45	1%
Concord Willow Pass Wellness	17	0%
Other	36	1%
Total	4,170	100%

Data Source: GHFI analysis of CCHP internal data

Geography

Nearly half of CCHP members with an asthma claim in the last year live in three zip codes – 94565 (Pittsburg), 94509 (Antioch), or 94520 (Concord). This reflects the higher number of people living in these zip codes relative to West County zip codes (Richmond, San Pablo), which also have some of the highest concentrations of asthma ED rates in the state (Figure 1). The inclusion of West County and neighboring zips comprises 83% of all CCHP members with asthma claims. Targeting the program towards where higher total number of CCHP members

with asthma live, rather than based only upon asthma ED rates allows for increased efficiencies from a service delivery perspective.

Hotspot analysis of CCHP members with any asthma-related claim (Apr 2018 – 2019)

46% of all CCHP members with asthma claims reside in one of 3 zipcodes (highlighted in darkest green)

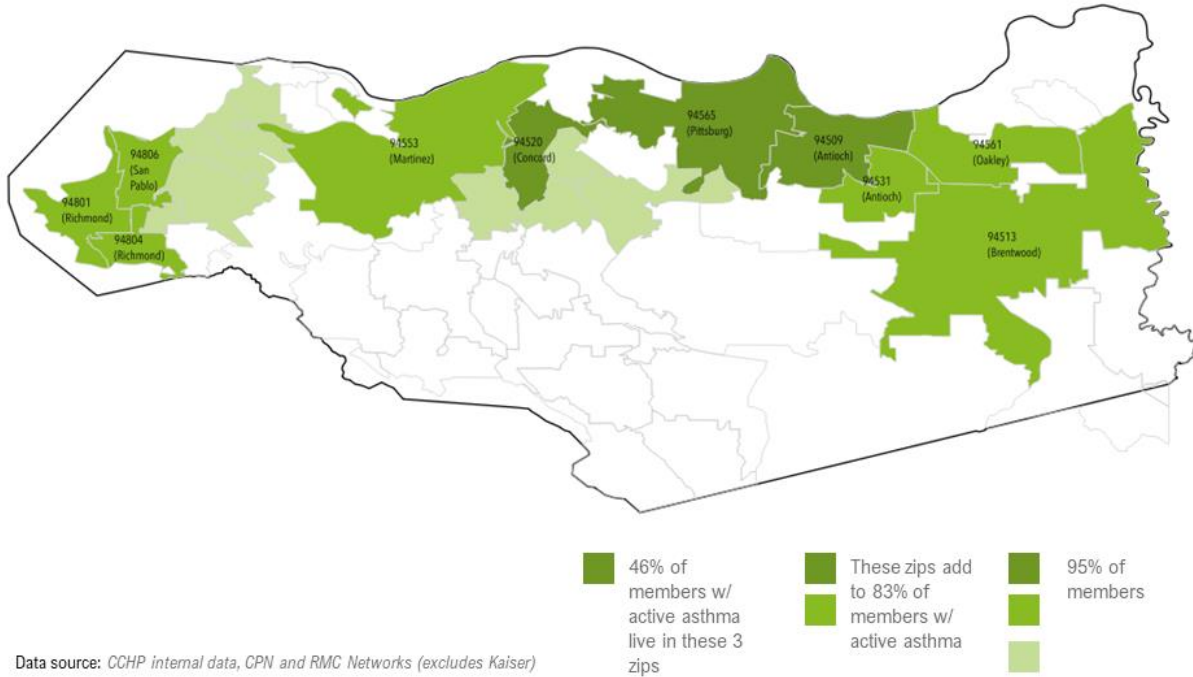


Figure 5

Table 6. Zipcodes of Primary Residence, CCHP Members ('18 - '19)

CCHP Medi-Cal members participating in either CPN or RMC network (excludes Kaiser) w/ at least one asthma-related claim in given year

Zip (City)	# w/ claim	% of Total
94565 (Pittsburg)	922	22%
94509 (Antioch)	658	16%
94520 (Concord)	316	8%
94806 (San Pablo)	245	6%
94804 (Richmond)	242	6%
94801 (Richmond)	237	6%
94531 (Antioch)	233	5%
94513 (Brentwood)	202	5%
94561 (Oakley)	201	5%
94553 (Martinez)	166	4%
Rest of zip codes	748	17%
Total	4,170	100%

Data Source: GHHI analysis of CCHP internal data

Intervention Design

The program’s home visiting and remediation services are designed to fill the gap between traditional clinical care and the recommendations from the National Heart, Lung, and Blood Institute Expert Panel 3 (NHLBI EPR-3)⁹ for effective asthma management (Table 7). The program addresses the gaps in two ways: 1) they provide education and medication management in the patient’s home, rather than in the physician’s office and 2) they assess and address the root causes of the patient’s asthma triggers by removing the underlying asthma triggers in their home.

Table 7. NHLBI EPR-3 recommendations for effective asthma management

EPR-3 Recommended Component	Traditional Clinical Care	Gap Addressed by Program
Measures of assessment and monitoring , obtained by objective tests, physical examination, patient history and patient report, to diagnose and assess the characteristics and severity of asthma and to monitor whether asthma control is achieved and maintained	Physician	(Home Visits)
Education for a partnership in asthma care	Physician (in clinic)	Home visits
Control of environmental factors and comorbid conditions that affect asthma		Home assessment Consumer Supplies Remediation of asthma triggers
Pharmacologic therapy	Clinical/Pulmonology Clinic as needed	

The program staffing model leverages three strengths in the County: the experienced staff who have run asthma home visiting pilots, the integrated care model of Contra Costa Health System (CCHS), and leveraged resources and housing expertise of energy efficiency programs. It consists of 5 direct service components, as further described in Figures 6 and 7 and below:

1. Home visits for asthma education and self-management
2. Home assessment to identify asthma triggers
3. Consumer supplies to manage asthma triggers (can be bought at store)
4. Minor to moderate home repair to remediate asthma triggers
5. Leveraged energy efficiency services

Additionally, there are 3 support functions:

- Outreach and enrollment
- Coordination with other providers
- Data management and evaluation

⁹ National Heart, Lung, and Blood Institute Expert Panel Report 3 (NHLBI EPR-3)







	Program Component	Staffing Organization
Home Visits	<p>3 Home Visits for Asthma Education Coordinate with PCP on Asthma Action Plan, medication usage training, environmental triggers training, follow up with PCP and care managers</p> <p>Consumer Supplies to reduce asthma triggers e.g. green cleaning supplies, hypo-allergenic mattress and pillow covers, integrated pest management, food storage containers</p>	
Home Assessment	<p>Environmental assessment Identify home-based asthma triggers and write remediation scope</p>	<p>Single-Family: County Weatherization</p> <p>Multi-Family: Association for Energy Affordability</p>
Trigger Remediation	<p>Remove asthma triggers from home Moisture issues (mold removal, ventilation, plumbing leaks) Allergens (carpet removal/cleaning), and Irritants (HVAC, combustion gases, VOCs)</p>	 
EE/ Weatherization	<p>Lower energy bills and improve comfort of home <i>Leveraged funds</i> Lighting, heat pumps, energy-efficient appliances, HVAC</p>	  

Figure 6

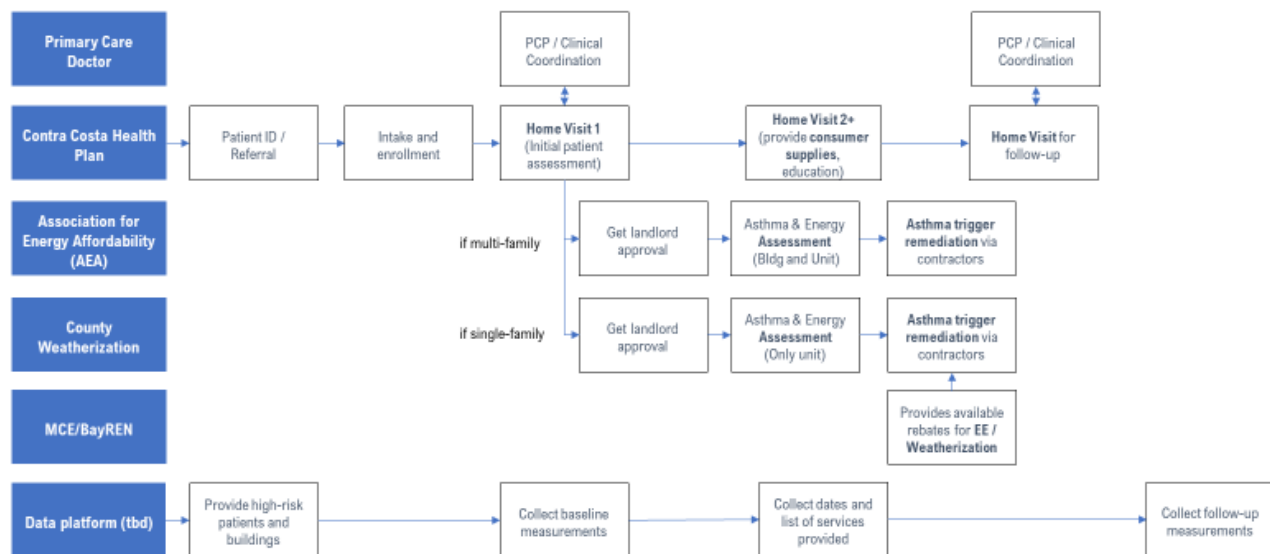


Figure 7

Program Process Flow

1. **Eligibility** – For Phase 1, there are no restrictions on age or geography. However, participants must be a member of Contra Costa Health Plan (CCHP) and have been identified as an at-risk asthma member through one of the following pathways:
 - a. *Have had multiple asthma-related ED visits within a calendar year or an asthma-related inpatient admission.* These members can be identified via two ways: 1) the claims record by CCHP staff with outreach via phone calls or through physicians or 2) at their Emergency Department or Hospital admission with the local hospital staff trained to provide program materials or for the EMR to flag CCHP staff to conduct outreach shortly after their discharge. Prior experience from the CCHP pilot found that of ~120 members contracted from a claims list, ~19 enrolled. This is similar to what GHHI has found nationwide, with enrollment rate from claims records in the range of 15 – 30%.
 - b. *Live in a multi-family building with multiple asthma patients.* The County has analyzed Contra Costa Health Plan data to identify several buildings in the County with multiple residents with asthma. AEA would reach out to their property managers to offer BayREN and MCE energy efficiency services, while CCHP would reach out to individual patients to ask if they would like to participate in the asthma program.
 - c. *Referred to the program by a physician or Public Health Nurse as somebody with poorly managed asthma.* Both physicians and Public Health Nurses have discretion to refer their patients who, based on their judgement, have poorly managed asthma, are at-risk of asthma hospitalizations, or live in a home that has uncontrolled asthma triggers. The CCHP asthma pilot is currently using this method for its second phase and has been able to enroll ~9 of 14 referrals.
 - d. *Referred to the asthma program by a Weatherization or Energy Efficiency program.* Weatherization and Energy Efficiency staff who have been trained in asthma trigger assessments have discretion to refer their customers, whether individuals or building owners of multi-family buildings into this program based on assessed need.
2. **Home Visiting and Consumer Supplies-** The home visits will be staffed by Contra Costa Health Plan’s Population Health program, which has overseen an asthma home visiting pilot that has served ~30 members over the last two years. The credentials of the home visiting staff will still need to be determined and will either be a community health worker or registered nurse. The home visiting staff will provide the consumer supplies, based on their assessment of patient need.

The home visit staff will conduct an initial assessment of the home for asthma triggers and review the participant’s eligibility for energy efficiency programs, such as LIFT (Low Income Family and Tenants), and then coordinate the more comprehensive energy and asthma assessment with the energy program implementer, who would manage the home modifications.

Housing the program within CCHP and CCHS provides two key advantages: 1) easy integration into Medi-Cal data systems and 2) ability to coordinate with other care management programs such as Community Connect and the Public Health Nursing Program.

- Home Assessment and Remediation** - The assessment and home remediation will be managed by two organizations with experience in the energy efficiency sector: Association for Energy Affordability and the County Weatherization program. If the patient lives in a multi-family building that is eligible for an existing energy efficiency program, Association for Energy Affordability will provide the asthma assessment and manage the contractors for home repairs. If the patient lives in a single-family home or an ineligible multi-family building, the County’s weatherization program will provide the assessment and contractor management. MCE, BayREN, and County Weatherization will layer in additional energy efficiency services, with other funding streams.

Partnering with the energy-efficiency sector provides two key advantages: 1) their staff are experts in building performance and can quickly be trained in asthma home assessments and program management and 2) they are able to provide additional energy efficiency services, by leveraging existing funds from other programs. This allows these energy programs to allocate their resources towards those who need it the most – the medically vulnerable. Table 8 provides a summary of the consumer supplies and contracted work, as well as which of these measures may be covered through existing weatherization or energy efficiency programs. A goal of this initiative is to secure funding for the unfunded measures.

Table 8. Home Remediation Measures by Asthma Trigger

Asthma Trigger	Consumer Supplies	Contracted Work
Moisture	<ul style="list-style-type: none"> Dehumidifier DampRid 	<ul style="list-style-type: none"> Plumbing (water leaks) Building Envelope leaks (broken windows, roof, walls) Remove humidity (ventilation*, air conditioner^, insulation**) Landscaping to keep water away Duct sealing**
Allergens	<ul style="list-style-type: none"> HEPA vacuum cleaner Hypo-allergenic bedding Food storage/garbage cans HEPA air filters 	<ul style="list-style-type: none"> Ventilation*, HEPA air filters^ Carpet cleaning and/or removal Mold removal Integrated pest management
Irritants	<ul style="list-style-type: none"> Green cleaning supplies 	<ul style="list-style-type: none"> Improve ventilation and clean air filters around appliances (water heater, boiler, stove) Fix gas leaks**
Other health/safety	<ul style="list-style-type: none"> CO/Smoke detectors 	<ul style="list-style-type: none"> Leveraged funding (lead-hazard control, weatherization, injury prevention)

*Covered by Weatherization, not AEA

** Covered by both Weatherization and AEA

^Weatherization provides non-HEPA filters and can provide air conditioning with physician note of medical necessity.

4. **Data Management and Evaluation** – While currently each partner uses a different data system, they will develop a shared data platform that meets both healthcare privacy and client confidentiality requirements. Currently, the partners use the following data platforms:

- a. *AEA – Salesforce*
- b. *MCE – ServTraq, a database developed by Central Coast Weatherization*
- c. *County Weatherization – paper forms*

GHHI, in consultation with a national stakeholder group, recommends selecting from the following metrics to evaluate this program¹⁰:

- Core Metrics
 - Reduced hospitalizations for asthma, asthma hospitalization rate
 - Reduced ED visits for asthma, asthma ED visit rate
 - Asthma Medication Ratio (AMR)
 - Medication Management for Asthma (MMA)
 - Asthma Control
 - Asthma Severity
 - Reduced proportion of nonsmokers exposed to secondhand smoke
 - Increased proportion of smoke-free homes
 - Increased proportion of person with current asthma who receive formal patient education Asthma Action Plan
 - Increased proportion of persons with current asthma with prescribed inhalers who receive instruction on their use
 - Increased proportion of person with current asthma who do not use more than one canister of short-acting inhaled beta agonist per month
 - Increased proportion of persons with current asthma who have had at least one routine follow-up visit in the past 12 months
 - Primary Care connection after ED visits for asthma
- Supplemental Metrics
 - Asthma-specific cost of care
 - Total cost of care
 - Reduced proportion of persons with asthma who miss school or work days; missed school or work days due to asthma
 - Improved Quality of Life for patient and caregiver

¹⁰ Recommendations for Evaluation Metrics for Asthma Home Visiting Programs (2019). See https://www.greenandhealthyhomes.org/wp-content/uploads/GHHI_EMHOME_Publication_2019.pdf

Program Costs

The program’s cost for 50 enrollees were estimated by synthesizing program cost data from asthma programs partnered with GHHI, RAMP’s estimated program costs for their legislative bill, and discussions with program staff on their experience running similar programs. The home visiting staff assumes a Community Health Worker position – this would increase if using a nurse or other staffing level. Additionally, the program budget and participants served may be adjusted to reflect a full-time load for the home visiting staff (i.e. if they need to serve more than 50 enrollees to pay for a full FTE).

Program Component	Service Partner	Potential Funders (Prioritized)	Avg Cost (Per Enrollee)	Total Program Cost (50 enrollees)
Recruitment and Intake				
Outreach Forms/Intake	Contra Costa Health Plan (Population Health)	\$15M Asthma Fund CCHP/CCHS	\$300 - \$500	\$15,000 - \$25,000
3 Home Visits for Education				
Medication Usage Training Environmental Triggers Training Coordination with PCP, care managers, and social services Follow-up with patient	Contra Costa Health Plan (Population Health)	\$15M Asthma Fund CCHP/CCHS	\$800 - \$1,200	\$40,000 - \$60,000
Consumer Supplies				
Allergens: bedding, vacuum cleaner, Pest Management, Air filters Irritants: Green cleaning supplies Moisture Reduction: Dehumidifier, Damp-Rid	Contra Costa Health Plan (Population Health)	\$15M Asthma Fund Foundations	\$300 - \$500	\$15,000 - \$25,000
Environmental Assessment				
Asthma and Energy Efficiency Assessment	Multi-family: AEA Single-family: County Weatherization	\$15M Asthma Fund Foundations	\$350 - \$700	\$17,500 - \$35,000
EE/Weatherization				
Ventilation, Duct Sealing, Insulation, combustion safety	AEA, County Weatherization, MCE/BayREN	LIHEAP/WAP MCE LIFT** MCE** / BayREN	<i>leveraged funds</i>	
Home Modifications				
Allergens: Mold removal, carpet cleaning/removal Irritants: Ventilation Moisture Reduction: Plumbing, air sealing, HVAC, Drainage	Multi-family: AEA Single-family: County Weatherization	CDBG*** BAAQMD Foundations	\$1,200 - \$2,000*	\$60,000 - \$100,000
Data				
Software Evaluation	TBD	CCHP/CCHS Foundations	\$250 - \$600	\$12,500 - \$30,000
Total			\$3,200 - \$5,500	\$160,000 - \$275,000

Program Benefits

Evidence Base

There is substantial evidence documenting the effectiveness of home-based asthma programs in reducing avoidable acute care healthcare visits (e.g. hospital visits). A systematic review by the Centers for Disease Control and Prevention's Community Preventive Services Task Force found that similar asthma programs to this one had a median decrease of 0.57 healthcare visits per year for pediatric populations¹¹. Evaluations of specific programs of both pediatric and adult populations have found significant decreases in unnecessary healthcare utilization when compared to a control group, which correlates to cost savings in the range of \$1,100 - \$2,200 per year for up to five years, totaling up to \$10,000 in potential savings over five years per program enrollee (Figure 8).

In partnership with Milliman, one of the nation's leading actuary firms, GHHI developed estimates for reductions across a range of specific impact metrics from home-based asthma programs:

- 25 – 40% reduction in acute care visits (adults vs kids)
 - Hospital admissions
 - Emergency Department visits
 - Ambulance trips
 - Urgent care visits
 - Unscheduled physician and specialist visits
- 20% increase in Asthma Medication Ratio adherence
- 20% decrease in missed school and work days
- 10-20% decrease in total cost of care for Medicaid members
- Improvement in caregiver/health worker satisfaction

These programs range in design – some only include home repairs (e.g. Cuyahoga, OH), while others only include home visits for asthma education with consumer supplies (e.g. Boston, MA). There have not been (and likely won't be because of inherent variability in the population and small sample sizes) studies that have identified the optimized asthma program design in terms of precise number of home visits or specific remediation measures. It is generally understood that including these components is effective, and that developing a service delivery model that works for the program partners and enrolled program members is the suggested route.

Applied to Contra Costa

GHHI applied these estimated utilization impacts to one year of Contra Costa Health Plan data to estimate the financial impact to CCHP of this asthma initiative. The potential savings depends significantly on the underlying utilization of the enrolled population – adults average more avoidable ED and IP visits than children¹² and members with multiple ED or IP visits for asthma are more likely to visit the ED or IP for asthma in the future than those that do not. These differences translate to increased Medi-Cal expenses for adults and higher utilizers (Figure 9). Those with higher asthma-related expenses tend to have greater savings opportunities.

¹¹ Asthma Control: Home-Base Multi-Trigger, Multicomponent Environmental Interventions. Community Preventive Services Task Force. 2011. Accessed August 2016. <http://www.thecommunityguide.org/asthma/multicomponent.html>.

¹² CCHP internal data

Home-Based Asthma Program Efficacy: Evidence Base from High Quality Studies

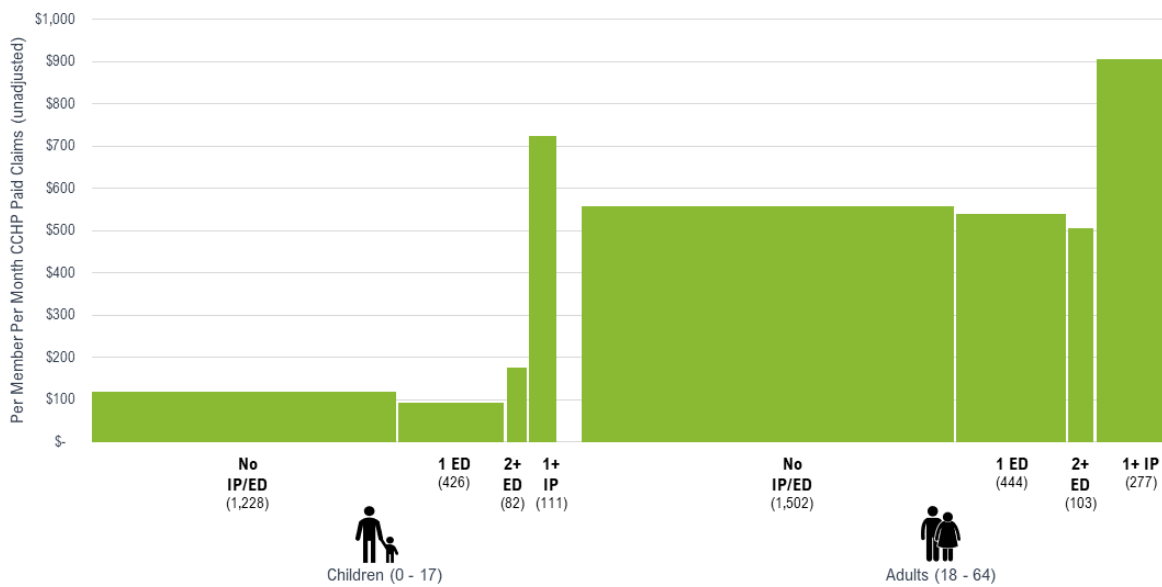
Program	Intervention	Population	Eligibility	(ED, Inpatient, Unscheduled Doctor) vs. Control					Avg Savings (TCOC)		Avg Program Cost
				Year 1	2	3	4	5	PMPY	Per Member, 5-year	Per member, one-time
Rainbow Babies and Children Hospital Cuyahoga, OH	Primarily Remediation	29 Children (2-17)	Asthma-related hospitalizations + visible mold	69%							\$3,458
Green & Healthy Homes Initiative Baltimore, MD	Home Visits + Remediation	111 Children (2-14)	Asthma-diagnosis						\$2,061		\$5,089
Children's Community Asthma Initiative Boston, MA	Home Visits	268 Children	Asthma-related hospitalizations	30%	39%	21%	60%	50%	\$1,137*	\$5,685	\$2,132
National Inner-City Asthma Study Boston, Bronx, Chicago, Dallas, New York, Seattle, Tucson	Home Visits	408 Children (5-11)	Asthma-related hospitalizations + positive allergy test	14%	16%						\$1,750
Changing High-Risk Asthma in Memphis Through Partnership (CHAMP) Memphis, TN	Home Visits	476 Children (2-17)	Asthma-related hospitalizations	26%	26%	26%			\$2,180	\$6,450 (three-year)	\$5,000
Supporting Asthma Self-Management Behaviors in Older Adults (SAMBA) New York, NY	Home Visits	90 Adults (60+)	Asthma-diagnosis	51%							
Home-Based Asthma Support and Education trial (HomeBASE) King County, WA	Home Visits	161 Adults (18-65)	Asthma-diagnosis	6%							\$1,300

*Hospital-related costs only
TCOC: Total Cost of Care; PMPY: Per Member Per Year; ED: Emergency Department

Figure 8

One-Year Per Member Per Month (PMPM) Costs by Age and Asthma Utilization

CCHP Medi-Cal members participating in either CPN or RMC network (excludes Kaiser) w/ at least one asthma-related claim, April 2018 – April 2019



Data source: GHHI analysis of CCHP internal data

Trigger Group (width represents # of members who meet criteria)

Figure 9

GHHI estimated the financial impact of two enrollment scenarios: 1) Enrolling any CCHP member with an asthma diagnosis (4,170 members over one year) and 2) Targeting enrollment to CCHP members with multiple asthma-related ED visits or an asthma-related inpatient visit (572 members). These estimates are calculated against a control group – even in the absence of an intervention, healthcare costs typically go down in years following an asthma hospitalization, referred to as ‘regression to mean.’ Additionally, these estimated cost savings account for enrollees who drop off the health plan, and thus no longer accrue savings to the health plan, which is referred to as ‘attrition.’ Figure 10 illustrates the cumulative savings estimated for an average enrollee under the two scenarios. When the program targets high utilizers, **it reaches a positive ROI within 3 years**, while it does not reach positive ROI within 5 years when open to the broader asthma population. This may also suggest that members with less severe asthma need a smaller intervention budget – several successful asthma home visiting programs that don’t fully address housing-related asthma triggers have budgets under \$1,000 per enrollee.

These savings estimates are relatively conservative compared to the results shown in Figure 8 above for two primary reasons: 1) California’s average Medicaid costs are among the lowest in the country¹³ and 2) GHHI uses conservative assumptions in its modeling. The high-utilizer scenario shown in Figure 10 below averages between \$800 - \$1,200 in annual savings in each of the first 3 years compared to the three programs listed in Figure 8 which range in annual savings from \$1,100 - \$2,100. Additional detail on these savings calculations and assumptions can be found in Appendix A.

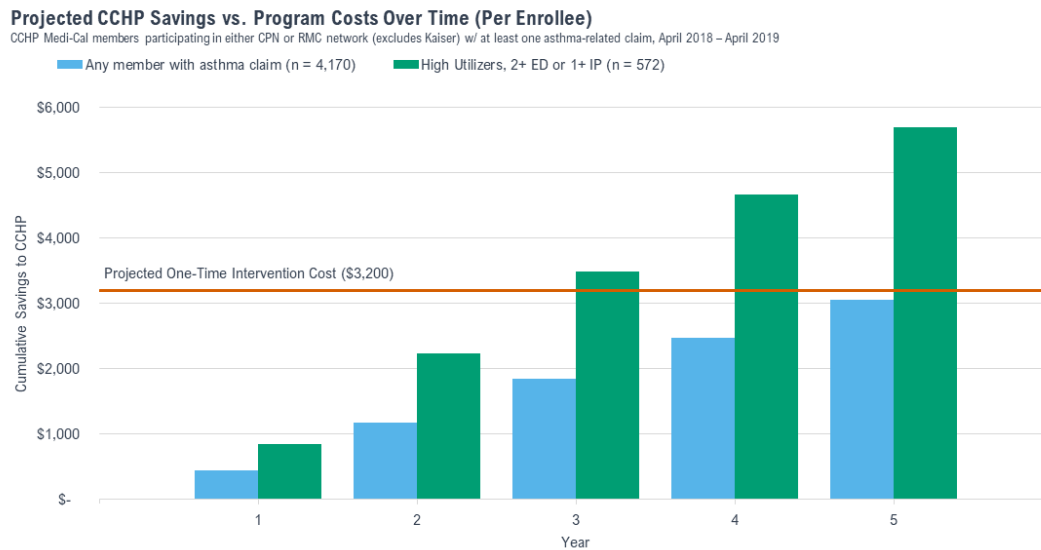


Figure 10

Long-term benefits

Beyond the direct benefits to the patients served through this program, this initiative can be an initial investment into developing a blueprint towards addressing the social determinants of health in Contra Costa County. This initiative will:

¹³ Kaiser Family Foundation, FY 2014, Medicaid Spending Per Enrollee. See: <https://www.kff.org/medicaid/state-indicator/medicaid-spending-per-enrollee/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>

- Develop programs that can use Medicaid dollars to address social determinants of health, bringing additional dollars via Medicaid into the County system
- Leverage energy efficiency dollars. For every dollar spent on the health aspects of the program, expect additional dollars to be spent on energy efficiency-related improvements.
- Develop operational proficiency of coordinated service delivery models that can grow into other healthy home issue areas

Additionally, while this analysis focuses on the impacts to the patients, the program is expected to have additional ancillary benefits for both the patient's family and caregiver(s). Home-based education and environmental remediation improve the housing quality for all members of the family and those that visit the family. Some of these family members may also be members of CCHP, in which case CCHP would accrue the financial benefits. These housing improvements also increase housing stability and the energy savings from the weatherization work improve disposable income for the families served.

Funding Strategies

Short-term funding opportunities

There are several potential funding sources for the initial phase of this initiative, which would allow the demonstration to both validate proof of concept and allow for the service provider partners to develop operational proficiency prior to scaling with long-term sustainable funding sources. High priority short-term funding sources are identified in Table 9, while additional funding sources that were investigated but deemed less likely are described below that.

Table 9. High Likelihood Short-Term Funding Sources

Funding Source	Description	Eligible Program Components	Income Eligibility	Geography Eligibility	Housing Eligibility
\$15M Asthma Fund (expected 2019 Q4 application period)	State legislature appropriated \$15M in funds for asthma home visiting programs, with up to \$1,000 for light home modifications. Awarded in FY 2020, but can be spent on up to 3 years of services	Recruitment/Intake Home Visits Consumer Supplies Environmental Assessment Data/Evaluation	Medi-Cal	any	any
MCE Low-Income Family and Tenants (LIFT) (existing program through 2021)	California Energy Commission (CEC) funded pilot to provide grant-funded energy efficiency, including some health/safety, measures to low income tenants.	Recruitment/Intake Environmental Assessment EE/Weatherization	<200% FPL	MCE jurisdictions (excludes Antioch, Brentwood, Clayton, Hercules, Orinda, Pleasant Hill)	Multi-family tenant focus
Bay Area Regional Energy Network (BayREN) (no defined application period)	BayREN has expressed interest in addressing connections between health and energy, including contractor workforce training and outreach (such as via home visits) to medically vulnerable customers	Recruitment/Intake Home Visits Environmental Assessment EE/Weatherization	>200% FPL & <\$125k hh income	any	Single-family
Community Development Block Grant (CDBG) (expected 2019 Q4 application period)	Funds can be used for home rehab of renters and homeowners	Home Modifications	any	Only: Antioch, Concord, Pittsburg, Richmond, Walnut Creek, Unincorporated County	any
Contra Costa County Funds (no defined application period)	If needed, can request staff funding, or leverage existing staff resources for service delivery	Recruitment/Intake Home Visits	CCHP Medi-Cal	any	any
LIHEAP/WAP (existing program)	Weatherization measures overlap with some asthma triggers	Weatherization	<200% FPL	any	any
Foundations (unknown application periods)	Community foundations may be interested in providing clearly defined gap funding	Gap funding	tbd	tbd	tbd

Lower Likelihood Short-term Funding Opportunities

Climate/Energy

- Cap/Trade funds (LIWP)
 - o Funds are appropriated annually
 - o While LIWP funds are being re-allocated to other regions besides the Bay Area, there is opportunity for other types of Cap/Trade funding for this program. For example, these dollars were allocated to high speed rail, but because that project is currently stalled, those funds are now potentially available.
- Chevron Settlement
 - o These funds are to address cumulative air impacts in areas with high levels of pollution from the Chevron refinery in Richmond. There are four refineries in the County, including two in Martinez (Shell, Marathon). There may be a settlement from the NuStar refinery fire near Martinez. The funds are currently allocated to a one-year monitoring project in Richmond but may be available after that for projects to address air impacts.
 - o To access these funds, the project needs to make the case for weatherization to reduce exposure to outdoor pollutants via weatherization, as a complement to reducing source of pollution.
- Partnerships (not necessarily funding opportunities)
 - o Cleaner Contra Costa is a targeted climate adaptation effort within the County and relates to its Sustainability Plan.
 - o OhmConnect is a software platform to reduce energy consumption through behavior change. Jamie Fine has discussed partnership opportunities with the team.
 - o TURN is a program for disconnections from overdue utility bills and two of the zip-codes with the highest number of participants are in Contra Costa County.
 - o Solar installations are often provided for multi-family housing by partners such as AEA (Association for Energy Affordability), Grid Alternatives, and CSE (Center for Sustainable Energy)

Housing/Community Development

- Partnerships (not necessarily funding opportunities)
 - o Insurance companies may be interested in reducing health-related causes of missed rent payments or damage to units. HAI is the largest insurer of public housing in the U.S.
 - o The County Housing Authority has homeless shelters and contracts with landlords for Section 8 and homeless. There may be opportunity to work with them on landlord education and/or requirements and referrals.
 - o CASA is a regional housing initiative run through the MTC that has recently adopted housing quality into its goals around housing access.

Healthcare

- Hospitals
 - o Hospitals allocate their community benefit dollars based on the priority needs identified through their Community Health Needs Assessment, which is conducted every 3 years.

- Hospitals may be interested in reducing their uninsured expenses
- Kaiser
 - Kaiser offers health insurance to the income bracket covered by BayREN and is a vertically integrated, progressive health care organization that is interested nationally at how to address housing-related health issues, including operating a fund for supportive housing
- Partnerships (not necessarily funding opportunities)
 - The SF Community Foundation / Bay Area Regional Health Inequalities Initiative may be interested in the project as it relates to its foci on People, Place, and Power
 - CARE is a medical baseline program to help with utility bills if a utility customer has a medical condition. It is run through Contra Costa Health Services rather than Department of Conservation and Development.
 - The Breathmobile is a mobile van targeting schools with high numbers of students with asthma and other respiratory issues
 - Health Leads is an organization that helps people sign up for social service programs and could help refer people into this program.
 - The YMCA has a school-based clinic at Coronado Middle School
 - School-based clinics typically focus on teenage behavior issues rather than asthma

Long-term Funding Opportunity

Beyond the demonstration phase of this initiative, there is considerable opportunity to secure long-term sustainable financing of home-based asthma programs through Medi-Cal and other healthcare funding sources. Four similar efforts supported by GHHI have recently secured, or are in the process of securing, Medicaid funding for addressing asthma’s home-based triggers (Figure 11). While there is considerable flexibility for Managed Care Organizations or states to provide additional Medi-Cal benefits to their members, the primary objective is to ensure that the federal government agrees to provide its share of the specific benefit offered. There are several pathways towards this objective available to Contra Costa Health Plan, including the following:

- **Value-Based Contracting** allows health plans to pay for improved health outcomes generated from non-traditionally covered services, such as home modifications or home visiting services. Through a value-based contract, health plans can pay retrospectively for these outcomes, through metrics such as total cost of care savings or improved quality metrics. Providers can secure third-party financing, such as pay for success investments, to provide upfront funds if needed. Value Based Purchasing (VBP) is consistent with the long-term direction of payment model reform across the United States, including California. The California Department of Health Care Services (DHCS) has proposed VBP requirements for MCOs in the FY 2019-2020 year.¹⁴
- **Classify program components as covered benefits through existing fee schedules.** There is some flexibility in the existing fee schedule, such as through Early and Periodic Screening, Diagnostic and Treatment (EPSDT) codes, for including home visits and assessments. This is the primary focus of the pending Senate Bill 207 in the California

¹⁴ See https://www.dhcs.ca.gov/provgovpart/Pages/VBP_Measures_19.aspx

legislature – to expand the definition of billable codes to cover home visits, assessments, and up to \$1,000 of minor environmental remediation.

- **Administrative payments** are often used to pay for supplementary services or pilot programs. GHHI is currently involved in a 2-year pilot with a health plan in Maryland. Under this payment model, the health plan pays for each member who is enrolled in the program - 75% is paid after the first home visit and 25% is paid after month 5 of enrollment. Because payments come from the health plan’s administrative budget, payments are not included in the numerator of the plans MLR, nor are they included in the plans rate-setting process. A focus of CalAIM is to build upon existing care management programs (e.g. Whole Person Care), which often are classified as administrative expenses. Additionally, a workgroup within CalAIM is investigating the opportunity to define services like the asthma home visiting program as an ‘in lieu of service’ (i.e. fix the member’s home in lieu of treating them in the emergency room)¹⁵.

While the primary focus of this plan focuses on demonstrating the business case for a home-based asthma program, GHHI offers additional technical assistance to further investigate these policy pathways.

	Baltimore, MD	Houston, TX	Salt Lake City, UT	New York, NY
Medicaid MCO	 An Anthem Company			
Healthy Homes Contractor				
Home Visiting Organization				
Housing Scope	Assessment Consumer Supplies	Assessment Consumer Supplies Home Modifications	Assessment Consumer Supplies Home Modifications	Assessment Consumer Supplies Home Modifications
Payment Type	Per member set payment (vendor agreement)	Per member per month + value-based contract (proposed)	Per member set payment (vendor agreement)	Retrospective outcomes payment based on TCOC savings (proposed)
Why?	Cost Savings Pilot lowered TCOC 33% (\$2,544) over 12 mo (Amerigroup calc)	MCO requirement Texas requires certain portion of MCO spending to be on VBP	Cost Savings Pilot lowered TCOC 67% (\$686 pmpm) over 6 mo (UUHP calc)	MCO Requirement Affinity required to have VBP and CBO contracts to address SDOH

Figure 11

¹⁵ See https://www.dhcs.ca.gov/ecm_ilos

Appendix A: Methodologies

The analysis in this report are primarily derived from the following four data sources:

- *Contra Costa Health Plan (CCHP) data.* CCHP provided internal claims-based data for the time period April 23, 2018 – April 23, 2019 on members that met the following requirements:
 - Continuous CCHP enrollment in six months prior to April 23, 2018
 - Enrolled in RMC (Regional Medical Center) and CPN (Community Provider Network) networks only; excludes Kaiser network
 - Enrolled on CCHP Medi-Cal Medicaid plan (~2/3 of total CCHP enrollment)
 - Does not include Commercial plan or County employees
 - Does not include other Medicaid plans, such as SPD (Seniors and Persons with Disabilities)
 - Had an asthma related claim between April 23, 2018 – April 23, 2019. Diagnoses within the QIP ASTHMA GROUPER ID 108194 are being used for this requirement.
 - The specific data is not shared in the attached excel workbooks for privacy reasons.
- *Office of Statewide Health Planning & Development* was the primary source for asthma-related ED visits and inpatient admissions at the County and State level. The data is derived from mandatory reporting requirements of hospitals to the Emergency Department and Patient Discharge Datasets. Diagnosis codes, used to identify asthma-related claims, are recorded by hospitals for reimbursement purposes and not for public health surveillance. Data from Tracking California, which based its report to GHHI on a 2017 OSHPD dataset, was the primary source throughout this report with one exception. The map in Figure 1 relied on Cal-Enviro Screen data which used a 2011-2013 OSHPD dataset.
- *American Community Survey, 2017 one-year estimates*, was the primary source for County-level demographic and housing data. The data was calculated using its public-use files. ACS historically undercounts Medicaid enrollment – this was adjusted for calculating County-level rates by using the Department of Health Care Services (DHCS) Certified Eligible counts.
- *GHHI Reference data* was the primary data source for projecting savings to Contra Costa Health Plan from this asthma home visiting initiative. It is based upon historical cost data from high-utilizing asthma Medicaid members at 12 different insurance companies across the country, totaling 1,600,000 member months of data. States represented include Maryland, New York, Texas, Michigan, Tennessee, Pennsylvania, Rhode Island, Salt Lake, Massachusetts, and Virginia.

Specific notes for tables and figures are provided below. Additional calculations can be found in the supplementary excel workbooks.

Table 1.

- *National rates:*
 - Accessed from Table B, CDC Healthcare Use 2016 at <https://www.cdc.gov/asthma/healthcare-use/healthcare-use-2016.htm> in October 2019.
 - Source data is CDC/NCHS. National Hospital Ambulatory Medical Care Survey (NHAMCS)
 - Asthma-related ED visit is defined as ED visit with any asthma-related primary diagnosis.
 - Rate is crude rate
 - Latino/Hispanic as presented is Hispanic rate, which is not exclusive of the White/African-American rates.
- *California and Contra Costa County rates:*
 - Accessed from Tracking California - Public Health Institute custom data report in October 2019. These queries can be replicated at <https://trackingcalifornia.org/asthma/query>, as of November 2019.
 - Source Data is Emergency Department and Patient Discharge Datasets from the State of California, Office of Statewide Health Planning and Development (OSHPD). Denominators for county level rate is based on population estimate from Department of Finance.
 - Asthma-related ED visit is defined as ED visit with any asthma-related primary diagnosis.
 - Rate is age-adjusted rate.
 - Latino/Hispanic as presented is defined as anyone identified as Hispanic. This can include Hispanic and any race.
- *CCHP Medi-Cal rates:*
 - Accessed from internal CCHP data. Report included any CCHP Medi-Cal member who had an asthma-related claim between April 22, 2018 – April 22, 2019. Report run on May 8, 2019 by Karen Schlein and Duane Eikleberry per definitions requested by Will Klein at GHHI.
 - Source data is CCHP claims.
 - Asthma-related ED visit is defined as an ED visit with either a) asthma as primary diagnosis or b) asthma as secondary diagnosis with a selected respiratory issue (pneumonia, bronchitis, upper respiratory tract infection, wheezing, or reactive airways disease).
 - Rate is crude rate, but is not meant to be population estimate, only actual rates of CCHP members.
 - Latino/Hispanic as presented is defined as anyone identified as Hispanic. This can include Hispanic and any race.

Figure 1.

- The figure maps asthma ED rates (visits per 10,000 people, averaged over 2011 – 2013) by census tract, using data from Cal Enviro Screen 3.0. This data can be accessed at <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30> as of November 15, 2019.
- The source data is California Office of Statewide Health Planning and Department (OSHPD), which is the same as used by Tracking California in other tables.

- The rate is age-adjusted and spatially modelled to convert the data from zip codes to census blocks using areal apportionment and then combined to arrive at census tract estimates by CalEnviroScreen.

Figure 2.

- The asthma ED visit rates for both California and Contra Costa were calculated as follows:
 - Numerator: Number of asthma ED visits by race/ethnicity and Medicaid status
 - These counts were provided by Tracking California. This is the same dataset as described in Table 1.
 - Denominator – Number of people by race/ethnicity and Medicaid status
 - This data is from the 2017 ACS estimates and follows the same methodology as Table 2 with one significant difference. The American Community Survey is known to undercount Medicaid enrollment¹⁶ and the California Department of Health Care Services (DHCS) does not release county-level estimates of Medicaid enrollment by age and race/ethnicity.
 - The ACS estimates of Medicaid enrollment were adjusted to match the DHCS count of ‘Certified Eligibles¹⁷.’ The ACS estimates grouped individuals into three categories: 1) receiving both Medicaid and Medicare benefits (“Dual”), 2) receiving Medicaid benefits, but not Medicare, and 3) those receiving neither Medicaid nor Medicare benefits.
 - A multiplier was created based on the ratio between the DHCS count and the ACS estimate. This multiplier was applied evenly across race/ethnicities and ages.
- The CCHP rates were calculated as described in Table 1.

Table 2.

- Income Categories are classified by 2017 American Community Survey estimates, public use file:
 - Low Income: Any individual classified as meeting either the definitions below:
 - Medi-Cal: Any individual classified as receiving Medicaid benefits.
 - HINS4 = 1
 - 200% FPL: Any individual living in a household with household income less than the 200% of the 2017 Federal Poverty Guidelines (referred to as Federal Poverty Level in this document, “FPL”).
 - 2017 Federal Poverty Guidelines accessed from <https://aspe.hhs.gov/2017-poverty-guidelines#guidelines> in November 2019.
 - 200% FPL is based on number of people in household. “NP” was used to determine this count. The household 200% FPL was calculated by correlating the NP field with the 2017 FPL table cited above.

¹⁶ Boudreaux, M., Noon, J. M., Fried, B., & Pascale, J. (2019). Medicaid expansion and the Medicaid undercount in the American Community Survey. Health services research.

¹⁷ <https://www.dhcs.ca.gov/dataandstats/statistics/Pages/Medi-Cal-Certified-Eligibles.aspx>

- Household Income = HINCP
 - Group or institutional housing, as defined by the housing weight (WGTP) = 0
 - Middle Income: Any individual that does not meet the Low-Income criteria and lives in a household with household income above 200% FPL and below \$125,000. This income criteria was selected to align with BayREN’s target income criteria, according to project staff.
 - Higher Income: Any individual that does not meet either of the above categories and lives in a household with household income above \$125,000.
- Estimates of the number of people with an asthma-related ED visit are calculated as follows:
 - Tracking California provided a table with the number of asthma ED visits in 2017 by primary payer (Medicaid, Medicare, Private, Other, Self-Pay), age, and race/ethnicity. This is the same dataset as used in Table 1.
 - Asthma ED visit rates were calculated using 2017 ACS estimates. Individuals were classified to the 5 primary payer categories as follows:
 - Medicaid: Any individual receiving Medicaid, Medical Assistance, or any kind of government-assistance plan for those with low-incomes or a disability benefits (includes those also receiving Medicare)
 - HINS4 = 1
 - Medicare: Any individual receiving Medicare benefits that is not also receiving Medicaid benefits.
 - HINS4 = 0 & HINS3 = 1
 - Private: Any individual a) receiving insurance through a current or former employer or union or b) purchased directly from an insurance company that is not also receiving Medicaid or Medicare
 - (HINS1 = 1 or HINS2 = 1) & HINS4 = 0 & HINS3 = 0
 - Other: Any individual receiving insurance through a) TRICARE or other military health care, b) Veteran’s Affairs, or c) Indian Health Service who also are not receiving Medicaid, Medicare, or Private insurance as defined above.
 - (HINS5 = 1 or HINS6 = 1 or HINS7 = 1) & HINS4 = 0 & HINS3 = 0 & HINS2 = 0 & HINS1 = 0
 - Self-Pay: Any individual who is not classified as having any of the insurance types listed above
 - HINS7 = 0 & HINS6 = 0 & HINS5 = 0 & HINS4 = 0 & HINS3 = 0 & HINS2 = 0 & HINS1 = 0
 - Rates were calculated by dividing the Asthma ED Visit counts (Tracking California) by the population counts (ACS). The ACS under-counts Medicaid enrollment. However, for this purpose, the ACS estimates were not adjusted to match the California Department of Health Care Services (DHCS) count of ‘Certified Eligibles’ (i.e. Medicaid enrollment) because it is unclear which insurance type would decrease to compensate for the increase in Medicaid enrollment.
 - Asthma ED Visit rates were converted to estimates of people with at least one asthma ED visit by using data from CCHP Medi-Cal to calculate an average

number of asthma ED visits per person (only including those with at least one visit in a given year). These rates were applied by age group and assumed constant across race/ethnicity and insurance type.

- Specific calculations can be found in Appendix XX and in the corresponding Excel workbook.

Table 3.

- Income categories are the same as Table 2
- Individuals are assigned housing type as follows:
 - Multi-family: Any individual living in a housing unit defined as 5 or more units, regardless of rental status
 - BLD = 6, 7, 8, or 9
 - SF-rent: Any individual living in housing unit defined as a) rented (TEN = 3) and b) is classified as one of the following building types (BLD):
 - 2 (One-family house detached)
 - 3 (One-family house attached)
 - 4 (2 apartments)
 - 5 (3-4 apartments)
 - SF own-occ: Any individual living in the building types defined above for SF-rent, but with a housing tenure of either a) Owned free and clear (TEN = 2) or b) Owned with mortgage or loan (TEN = 1).
 - Other: Any other combination of building type and tenure, including the following:
 - Occupied without payment of rent (TEN = 4)
 - Mobile home or trailer (BLD = 1)
 - Boat, RV, van, etc. (BLD = 10)
 - The other category also includes those living in group homes

Table 4.

- CCHP Medi-Cal Member data is derived from CCHP.
 - Hispanic is defined as anybody reporting ethnicity as Hispanic or race as Latino
 - The numerator, CCHP asthma ED visit count, is derived from data from April 23, 2018 – April 22, 2019.
 - The denominator, CCHP enrollment count, is as of October 2019.
- County-Wide Population estimates are derived from ACS 2017 estimates.
 - Race/Ethnicity is defined as follows:
 - Black: Not Hispanic (HISP \neq 1) & RAC1P = 2
 - Hispanic: HISP > 1, regardless of Race
 - Asian Pacific Islander: Not Hispanic (HISP \neq 1) & (RAC1P = 6 or RAC1P = 7)
 - White: Not Hispanic (HISP \neq 1) & RAC1P = 1
 - Other: Not Hispanic (HISP \neq 1) & none of the races identified above
 - Gender: Based upon SEX variable, 1 = Male, 2 = Female
 - Primary language is defined based on the household language as defined below:
 - English: HHL = 1
 - Spanish: HHL = 2
 - Other: HHL = 3 or 4 or 5 or b

- While the number enrolled in Medicaid listed is based upon DHCS Certified Eligible count, the percentages are calculated based upon ACS estimates for those who are classified as receiving Medicaid assistance, without adjustment.

Figure 4.

- CCHP Medi-Cal Member data is derived from CCHP.
- Asthma-related inpatient admits (IP) and Emergency Department visits (ED) are defined as having asthma as primary diagnosis or asthma as secondary diagnosis with a related respiratory as primary diagnosis.
- The data excludes those in the Kaiser network.

Table 5.

- CCHP Medi-Cal Member data is derived from CCHP.
- The data excludes those in the Kaiser network.

Figure 5 and Table 6.

- CCHP Medi-Cal Member data is derived from CCHP.
- The data excludes those in the Kaiser network.

Figure 8

Rainbow Babies and Children Hospital

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Green & Healthy Homes Initiative

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National Inner-City Asthma Study

Morgan, W. J., Crain, E. F., Gruchalla, R. S., O'Connor, G. T., Kattan, M., Evans III, R., ... & Walter, M. (2004). Results of a home-based environmental intervention among urban children with asthma. *New England Journal of Medicine*, 351(11), 1068-1080.

Changing High-Risk Asthma in Memphis Through Partnership (CHAMP)

NORC at the University of Chicago (2017). *Third Annual Report Addendum, HCIA Disease-Specific Evaluation*. (Contract No. HSSM-500-2011-00002I, Order No. HHSM-500-T00009). Bethesda, MD: Adil Moiduddin.

Supporting Asthma Self-Management Behaviors in Older Adults (SAMBA)

Federman, A. D., O’Conor, R., Mindlis, I., Hoy-Rosas, J., Hauser, D., Lurio, J., ... & Wisnivesky, J. P. (2019). Effect of a Self-management Support Intervention on Asthma Outcomes in Older Adults: The SAMBA Study Randomized Clinical Trial. *JAMA internal medicine*.

Home-Based Asthma Support and Education trial (HomeBASE)

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Figure 9

- The data is based on a GHHI analysis of CCHP internal data
- The PMPM does not include pharmacy costs and has not been adjusted based on GHHI reference data. It does include an estimate of incurred, but not paid, claims for the final month of the selected year – the data was run in early May 2019 for claims through April 23, 2019.

Figure 10

The savings estimate for CCHP Medi-Cal members with asthma is the difference between the members’ projected CCHP costs with (‘treatment’) and without (‘baseline’) the home asthma program. These calculations were done for two different eligibility groups: 1) a broad eligibility criterion that includes any member with an asthma-related claim over a single year and 2) a high-utilizer criterion that only includes the members with multiple asthma-related ED visits in a single year or at least one asthma-related inpatient admission. The 572 members in this high-utilizer group comprised 60% of all asthma-related ED and inpatient admissions for CCHP’s Medi-Cal members between April 2018 – April 2019.

The specific methodology for these calculations is included in the attached Excel workbooks – CCHP Financial Impact Analysis – and is briefly summarized below.

The members’ 5-year baseline cost estimate is based upon the following (“Summary Tab”):

- “Year 0 PMPM (Per Member Per Month)” – effectively the average monthly CCHP expenses in the year of their trigger event
 - The total expenses are adjusted to estimate lagged claims that have yet to be paid and then divided by total months enrolled of all members who meet the criteria to generate the PMPM
 - This PMPM is adjusted twice more:
 - 1) Estimated pharmacy costs are added using GHHI reference data (they were not included in initial data pull)
 - 2) This adjusted amount is weighted with GHHI reference data to account for inherent variation in the data
- Years 1 – 5 PMPM are estimated by using GHHI reference data that measures the regression to mean, or the phenomenon in which people with severe acute health issues (e.g. asthma inpatient admission) are not all likely to have an inpatient admission every

year after that – i.e. as a group, their costs will decrease on average in years following their inpatient admission.

The members' 5-year projected costs after receiving the home-based asthma program are then calculated as follows (“Optimistic and Conservative Savings Calcs”):

- A *treatment effect*, based upon a review of the literature and in consultation with Milliman, is applied to these projected baseline cost curves. A conservative and optimistic treatment effect are applied in two different scenarios.

The group's aggregate savings are then estimated by applying an attrition factor to this savings estimate (“Graphs”). The attrition factor accounts for CCHP members who fall off the Medi-Cal rolls, and would no longer accrue savings to the plan. It is based upon GHFI reference data.

Appendix B: Acronyms

ACS – American Community Survey
AEA – Association for Energy Affordability
API – Asian / Pacific Islander
BAAQMD – Bay Area Air Quality Management District
BayREN – Bay Area Regional Energy Network
CCHP – Contra Costa Health Plan
CCHS – Contra Costa Health Services
CDBG – Community Development Block Grant
CHIS – California Health Interview Survey
COPD - Chronic Obstructive Pulmonary Disease
CPN – Community Provider Network
DHCS – Department of Health Care Services
ED – Emergency Department
EMR – Electronic Medical Records
FPL – Federal Poverty Level
HEPA – High Efficiency Particulate Air
HH - Household
HVAC – Heating, Ventilation, and Air Conditioning
IP - Inpatient
LIFT – Low Income Family and Tenants
MCE – formerly Marin Clean Energy (now known as “MCE”)
MF – Multifamily
MLR – Medical Loss Ratio
OSHPD – Office of Statewide Health Planning and Development
PCP – Primary Care Provider
RMC – Regional Medical Center
SF – Single-Family
VBP – Value Based Purchasing
VOC – Volatile Organic Compounds
WAP – Weatherization Assistance Program

Appendix C: Organization Overview

MCE is dedicated to providing its customers with an integrated and comprehensive approach to resource conservation – providing a single point of contact for everything from traditional building efficiency upgrades and water efficiency, to health and safety modifications through its Green & Healthy Homes Initiative (GHHI) Marin program. MCE administers programs with the 3 belief that promoting resource conservation through an integrated platform that engages local program partners is a critical approach to achieving greener, healthier homes within its communities. MCE administers the collaborative GHHI Marin effort and has expanded its home assessments and local partnerships to fulfill GHHI National’s comprehensive model. MCE is the default electric provider for 14 of the 19 Contra Costa jurisdictions. While current GHHI efforts are only administered in Marin County, MCE’s goal is to provide green and healthy home services in all its territories and is committed to facilitating an asthma initiative in Contra Costa County

Contra Costa Health Services (CCHS) is an integrated health system, providing hospital and clinical care, health insurance, and Public Health Nursing and other public health services to all residents of the County. The mission of CCHS is to care for and improve the health of all people in Contra Costa County with special attention to those who are most vulnerable to health problems. CCHS provides services to approximately 175,000 county residents receiving Medicaid (Medical). The number of these Medical patients currently identified as having asthma is 15,660, and many of these Medical recipients have other medical vulnerabilities that will benefit from weatherization services and asthma trigger reduction measures. In addition, one of the goals of the Public Health Division’s recently adopted Strategic Plan is to promote improved respiratory health by addressing asthma triggers in the home and community environment, further strengthening the Public Health Division’s commitment to this effort.

The Contra Costa County Department of Conservation and Development (DCD) implements four (4) energy efficiency programs throughout the County. These programs are the Bay Area Regional Energy Network (BayREN), East Bay Energy Watch (EBEW), Neighborhood Preservation Program, and Weatherization Program. Each program provides resources to make homes or businesses more energy efficient based on building type and/or resident income. Implementation of these programs achieve the goals of the County’s Climate Action Plan adopted in 2015. DCD is committed to coordinating with MCE and CCHS in order to develop a local green and healthy homes program.

Green & Healthy Homes Initiative (GHHI) is a nonprofit organization whose mission is to break the link between unhealthy housing and unhealthy families. GHHI has 30 years of experience in fundraising, delivering high-quality evidence-based services, working with governments in jurisdictions around the country, and forming innovative cross-sector partnerships. GHHI has provided support to over 20 sites seeking to build strong, comprehensive asthma care management services and utilized this expertise to provide technical assistance to this project.