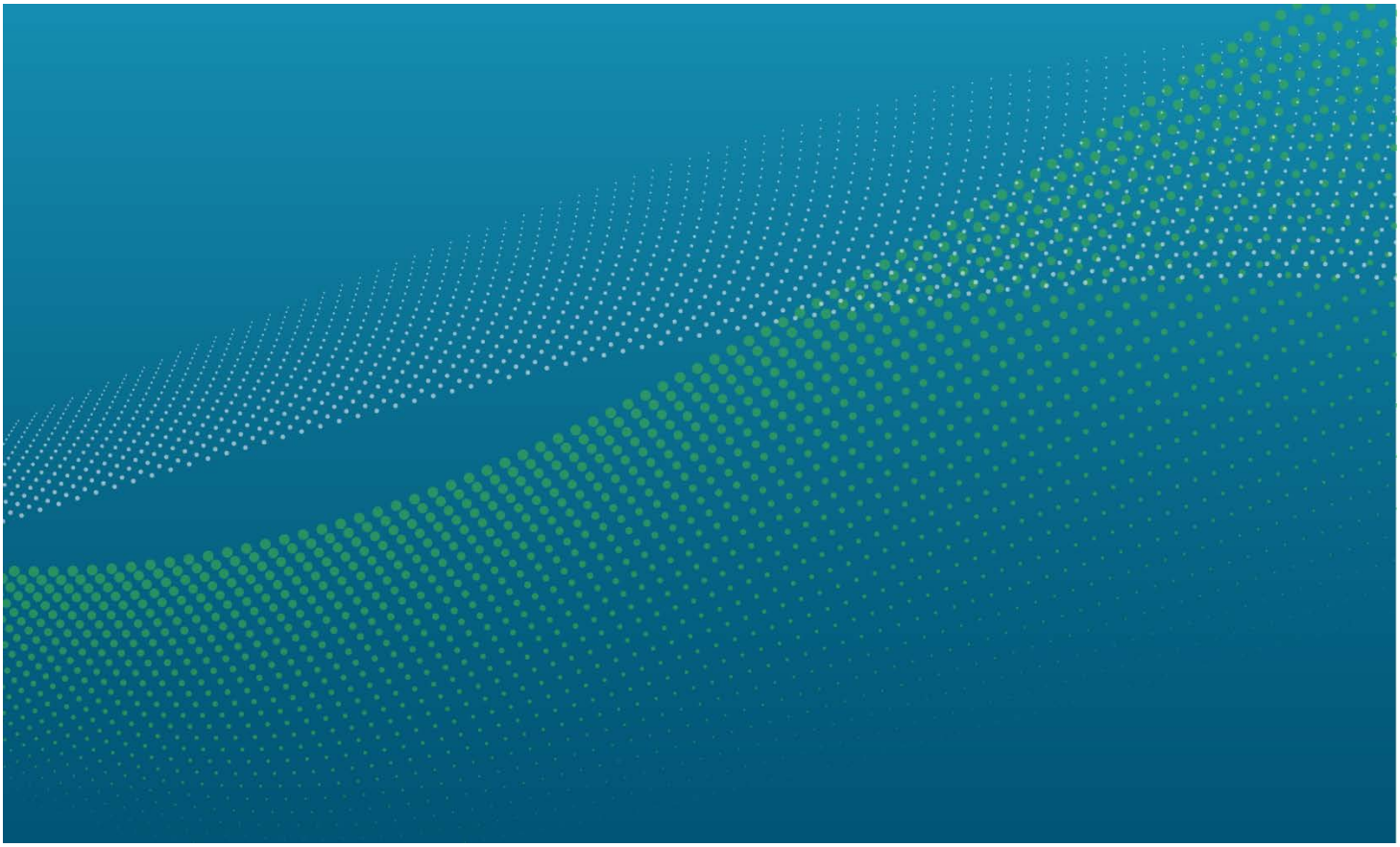

Healthy Homes Vermont 2019

EFFICIENCY VERMONT PROGRESS REPORT

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Efficiency Vermont

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Introduction

The Vermont Healthy Homes Story
Many Vermonters in low-income households are at a greater risk of health problems due in part to the buildings in which they live. The nexus between building energy efficiency and better health is now *the* target for improving housing conditions for vulnerable populations. It is a target shared by both the health and energy sectors, with historical and ongoing support from the social services sector.

After demonstrating a successful partnership among those three sectors in 2018, Efficiency Vermont expanded the energy-plus-health collaboration to additional locations, partners and health conditions in 2019. Together, the partners are applying their respective funding sources and human resources to pave the way for more positive health outcomes for people at risk of respiratory, trips / falls, and other conditions exacerbated by inadequate housing conditions.

Collectively the pilots are testing innovative energy-plus-health collaborations and whether these models may be scaled to a cost-effective component of energy efficiency programs statewide, and serve as a template for other jurisdictions.

The following progress report captures pilot expansion and lessons learned in 2019. Healthy Homes Vermont 2018 has additional background on the development of the energy-plus-health program at Efficiency Vermont and prior lessons learned.

Efficiency Vermont Healthy Homes Vision and Goals
Efficiency Vermont established the Healthy Homes Vision in 2017:
Through energy efficiency, Vermont homes are safe, affordable, comfortable, durable, and resilient. These attributes result in improved population health and a reduction in greenhouse gases.

The following Healthy Homes program objectives support the vision:

1. ***Providing cost-effective services that improve indoor environmental quality while reducing energy burden***
2. ***Increasing benefits through strong healthy-home collaborations and partnerships***
3. ***Providing creditable and valued leadership in the health / energy nexus***
4. ***Creating a clear policy advocacy and regulatory strategy for healthful, affordable homes.***

To meet program objectives and support this vision, Efficiency Vermont leveraged existing partnerships with the Vermont Office of Economic Opportunity (OEO) Weatherization Program, the Department of Health, community organizations, and hospitals to establish a Healthy Homes Program incorporating the following specific aims:

- Integrate healthy-home principles and resources into all of Efficiency Vermont's residential program designs and services

- Build a culture of healthy homes in Vermont by raising awareness with consumers, health care providers, and building contractors on the connections among indoor environmental quality, energy efficiency, and health.
- Launch pilots testing how a collaboration among health care providers, weatherization programs, community service programs, and Efficiency Vermont can use a Weatherization Plus Health service approach for customers with chronic respiratory illness and/or in-home fall hazards improving housing quality and indoor air quality, and tracking health outcomes from these services.
- Quantify the health-related non-energy benefits of weatherization retrofits.
- Identify health-specific and indoor environmental quality-specific products with opportunities for energy efficiency improvements.
- Create new tracking procedures for measuring and reporting indoor air quality before and after energy efficiency services.
- Establish sustainable funding models for energy-plus-health residential interventions.

Figure 1. Attributes of healthy homes.

Efficiency Vermont follows the U.S. Centers for Disease Control and Prevention (CDC) and the National Center for Healthy Housing (NCHH) in defining a *healthy home* as one that is: dry, clean, safe, well ventilated, pest free, contaminant free, maintained, and thermally controlled.

Efficiency Vermont supports utility ratepayers in meeting their energy goals *while also ensuring that home energy upgrade projects consider the eight principles of a healthy home*.

Background and Significance: The Vermont Housing, Energy Efficiency, and Health Markets

Housing Conditions
Vermont Homes present the following challenges:

- **General Conditions.** Age of an average Vermont home is 66 years. A significant number of those houses are cold in the winter, have high air leakage, and have basement moisture problems for at least some of the year. Many Vermonters struggle to maintain comfortable indoor living temperatures in both the winter and summer. Deferred maintenance is common to houses in poor condition.
- **Financial burden.** Thirty-one percent of Vermont's children live in households with a high housing cost burden; and 14% of Vermont's children live in poverty.[1] Vermonters spend 10% of household income on energy, on average, with a range of spending 6% to 20% of income on energy across the state.[2]
- **Chronicity.** Low-income Vermonters are especially likely to live in poor-quality housing, which exacerbates adverse health conditions. Finding ways to fund routine home maintenance and make major repairs for Vermonters on Medicaid is challenging. Medicaid recipients are three times more likely to visit an emergency department for asthma than those on other insurance.
- **Conditions in the home: Pests.** Mice and other rodents create chronic pest issues for homeowners in Vermont, and there are few certified integrated pest management companies.
- **Conditions in the home: Contaminants.** Many homes have lead paint, asbestos insulation (or other asbestos-containing materials), active knob-and-tube wiring, and other known and unknown hazardous building materials. Sixty percent of Vermont housing is likely to contain lead-based paint. More than a quarter (26%) of the housing was built prior to 1940.[3] In 2017, 157 Vermont children who received blood lead screenings had elevated blood lead levels (5 µg/dL or higher).[4] Tens of thousands of untested and unregulated chemicals are on the market making it challenging for any consumer to live contaminant-free in a home.
- **Respiratory problems.** In Vermont, 12% of adults and 7% of children have asthma.[5] Of these, 81% have two or more indoor environmental triggers at home.[6] One in eight Vermont homes has elevated levels of indoor radon.[7]

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[1] National Center for Healthy Housing (NCHH), 2019. *Vermont 2019 Healthy Housing Fact Sheet.* https://nchh.org/resource-library/fact-sheet_state-healthy-housing_vt.pdf

[2] Sears, Justine., and Kelly Lucci, 2019. *Vermont Energy Burden Report*. Efficiency Vermont. https://www.efficiencyvermont.com/Media/Default/docs/white-papers/2019%20Vermont%20Energy%20Burden%20Report.pdf

[3] NMR Group, Inc., 2019. *Vermont Single-Family Existing Homes Overall Report*. https://publicservice.vermont.gov/sites/dps/files/documents/VT%20SF%20Existing%20Homes%20Overall%20Report%20-%20FINAL%20022719.pdf

[4] NCHH. *Vermont 2019 Healthy Housing Fact Sheet.*

[5] Ibid

[6] Ibid

[7] Ibid

- **Injury.** Falls are the leading cause of injury-related deaths in Vermont[8], and one in three Vermonters over age 45 have fallen. With an aging population, Vermont homes require accessibility upgrades to enable residents to age in place, saving health care costs and limited assisted living resources.

Energy Transformation

Three efficiency utilities exist in Vermont: Burlington Electric Department, Efficiency Vermont and Vermont Gas Systems. Each provides incentives for home weatherization – collectively less than $12M annually.[9] The VT OEO Weatherization Program combines state funding (~$10M annually) and federal funding (~$1.3M annually) to deliver weatherization to low-income households. Additionally, every electric distribution utility (DU) in the state is required to reduce fossil fuel consumed by DU customers by 12% by 2032, and weatherization is an option for meeting this goal.

Despite the extensive investments towards weatherization in the state, the estimated costs for retrofitting homes to be comfortable, durable and healthy far exceeds current allocations for weatherization. In 2013, the Thermal Efficiency Task Force estimated $927 million was needed for Vermont to meet the state's Comprehensive Energy Plan goal of weatherizing 80,000 homes by 2020. [10]

Efficiency program administrators are challenged to find additional funding sources and increase customer participation in weatherization programs. Home retrofits are invasive and complex, requiring a high level of interest, commitment and participation on the part of the homeowner and residents.

Creative solutions are needed for Vermont to improve its housing stock. As efficiency utilities shift to meet new market challenges through strategic electrification and flexible load management while also tackling the complexities of whole-home retrofits, partnering with the health care sector opens the door to reaching new customers and funding streams to stretch limited ratepayer dollars.

Healthcare Innovation

Nationally recognized for impact, the Vermont Blueprint for Health was formed to design community-led strategies for improving health and well-being after the passing of health reform legislation in 2006. In 2011, Vermont established the Green Mountain Care Board to oversee health care payment and delivery system reforms designed to control the rate of growth of health care costs while maintaining health care quality. These and other advancements in Vermont created the foundation for the state to receive $9.5 million in Centers for Medicare and Medicaid Services

[8] Vermont Department of Health, 2018. State Health Assessment 2018. https://www.healthvermont.gov/sites/default/files/documents/pdf/VT%20State%20Health%20Assessment%202018%20Full%20Report.pdf

[9] Vermont Department of Public Service, 2020. "2020 Annual Energy Report," https://legislature.vermont.gov/assets/Legislative-Reports/2020-Annual-202be-report-Final.pdf

[10] Thermal Efficiency Task Force, 2013. "Thermal Efficiency Task Force Analysis and Recmmendations," https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/TETF/TETF%20Report%20to%20the%20Legislature_FINAL_1_15_13_2.pdf

innovation funding to create an all-payer accountable care organization (ACO) model. The ACO began in 2017. Vermont also and received a 5-year extension on the state's 1115(a) Medicaid demonstration enabling Medicaid to be a full partner in VT's ACO model.

With aggressive targets for alternative payment models, limits to health care expenditure growth, population health outcomes and quality of care, the pilot health care reform program is creating statewide transformation in care delivery and reimbursement. Providers are incentivized to focus on the social determinants of health – the social, economic and physical environments that impact health, creating a welcoming opportunity for cross-sector energy-plus-health collaborations.

Collaboration
Energy-plus-health programs have the potential to support energy efficiency utilities and health care providers in meeting their aggressive goals while providing safer housing and reducing the energy burden for Vermonters today and for the generations to come. It is within this context that Vermont Healthy Homes Pilots seek to identify scalable models for sustainable funding and implementation statewide.

Research Questions: How Much and How Effective?

Three pilots were designed to test how a collaboration among health care providers, weatherization programs, community service providers, and Efficiency Vermont can deliver an energy-plus-health service approach aimed at improving housing quality, indoor air quality, and customer health. Two pilots focus on asthma and COPD. The third pilot addresses trip and fall prevention. Tracking health outcomes from these services is a precursor to establishing sustainable funding models for energy-plus-health residential interventions.

The combination of home weatherization-plus-healthy-home repair measures and in-home patient education on energy and self-managed care practices is expected to reduce symptoms and acute exacerbation events for low-income COPD and asthma patients, reduce fall incidence and improve patient quality of life. The following questions pertain from this assumption:

1. **Lowering medical costs and improved quality of life.** To what extent will reducing acute exacerbation and fall events for patients also reduce the use of Medicaid and / or insurance services? To what extent will the reduction in these events improve patient quality of life?
2. **Enhancing air quality.** To what extent will indoor air quality improve as a result of home weatherization-plus-healthy-home repair measures, and which measures are most commonly needed?

    - This question will consider changes in PM 2.5, carbon dioxide (CO_2), relative humidity, temperature, and radon levels.
3. **Targeted and whole-house ventilation vs exhaust-only ventilation.** To what extent do homes receiving whole-house and/or spot-balanced ventilation offer improvements in indoor air quality and health, compared to homes receiving only exhaust-only spot ventilation:
    - This question will also consider the effects of whole-house-balanced ventilation system measures on IAQ and health.
4. **Fall prevention.** To what extent will residents feel less likely to fall at home and what improvement measures are commonly needed? Is there a difference in outcomes when residents receive, or do not receive, in-home coaching from a nurse?
5. **Efficiency program impacts.** How does integrating plus-health assessment and implementation into resource-constrained energy efficiency programs impact those program providers?
6. **Healthcare financial support for energy plus health.** Do health care partners accept as reasonable the full program costs of providing weatherization-plus-health measures and in-home patient education as a supplement to traditional treatment and medication programs for patients with severe COPD / asthma? Are the estimated falls avoided from in-home fall prevention retrofits and coaching valued at a cost equal to or greater than the program expenses?
    - These questions will also consider the costs plus the administration of partnerships with weatherization agencies and health care providers.
    - These questions will consider the answers in the context of improved outcomes for high-risk COPD / asthma patients or high-risk of falling patients.

Methods: The Healthy Homes Pilots

Northeast Kingdom: NRVH and NETO
In 2018, Efficiency Vermont, Northeastern Vermont Regional Hospital (NVRH), Vermont WAP, and NETO (the local WAP affiliate) launched a 10-home pilot for COPD and asthma patients.

Springfield area: SMCS and SEVCA
In 2019, Efficiency Vermont, Springfield Medical Care Systems (SMCS), Vermont WAP, and SEVCA (the local WAP affiliate) launched a 10-home pilot for asthma patients. This program was designed and implemented identically to the first pilot program with NVRH and NETO, with one exception – focusing on asthma-only due to asthma-related grant funding from VDH. Once the grant funding ended, the collaboration decided to expand the pilot to include COPD thereby expanding the eligible patient population and fully aligning the pilot with the Northeast Kingdom pilot.

Champlain Valley: UVM and CVOEO

Using results from the One Touch data identifying weatherization recipients as at-risk for falling[11], the Vermont WAP recognized an opportunity to collaborate with the University of Vermont Medical Center's Falls and Fires Prevention program and the Vermont Department of Health Injury Prevention program beyond basic referrals. In 2019, Efficiency Vermont, CVOEO (the local WAP affiliate) and UVM Community Health Improvement launched a 20-home pilot for patients at-risk of falling at home.

These three pilots seek to quantify the effects of efficiency-plus-health measures on patients, health care providers, and weatherization service providers. The objective is to expand Vermont-specific evidence related to the intersection of energy efficiency and health, so that this evidence could inform future policy and program decisions.

Analysis and Discussion: Pilots Under Way

Northeast Kingdom: NVRH and NETO

Pilot process

NVRH identifies patients with COPD or asthma. Participants are non-smokers, homeowners (or renters with cooperative landlords), and meet WAP income eligibility (below 80% area median income (AMI)). NVRH assists participants in completing NETO's application, conducts an initial home environmental assessment and provides self-managed care coaching to each patient.

NETO confirms WAP eligibility and schedules a walkthrough of the home, accompanied by an Efficiency Vermont staff person.[12] In consultation with the participant, NETO and Efficiency Vermont identify energy-plus-health opportunities for the home.

Efficiency Vermont installs air quality monitoring equipment to measure indoor and outdoor fine particulate matter ($PM_{2.5}$), relative humidity (RH), temperature, indoor nitrogen dioxide, indoor radon, and indoor carbon dioxide (CO_2).[13] The air quality test results inform the energy-plus-health scope of work.

When appropriate, program partners supported participants to coordinate Medicaid's Choices for Care for in-home cleaning, Vermont's Healthy & Lead-Safe Homes program, USDA Rural Development home repair programs, and other service offerings.

Efficiency Vermont managed the project, coordinating services as needed between partner organizations. NVRH, NETO/Vermont WAP, and Efficiency Vermont paid for supplies and repairs.

[11] One Touch data. https://data.surveygizmo.com/r/541053_5bd5b84b85bb51.74060046

[12] Both of the NETO and Efficiency Vermont assessors are BPI Healthy Homes Evaluator certified. http://www.bpi.org/certified-professionals/healthy-home-evaluator

[13] Efficiency Vermont updated monitoring equipment in 2019 and now uses the AirVisual Pro for CO_2, $PM_{2.5}$, RH and temperature in place of the Dylos, CO2 meter and Hobo meters. The remaining monitoring equipment remain the same.

NVRH conducted pre- and post-project health surveys to monitor changes in medical needs and quality of life. NETO tracked pre- and post-project energy use, and Efficiency Vermont conducted pre- and post-project air quality monitoring.

Northeast Kingdom pilot participants

By the end of 2019, six patients participated in the Northeast Kingdom pilot with NVRH and NETO as summarized in Table 1. Details for each home are provided on subsequent pages.

Table 1: Northeast Kingdom pilot participants

Home	Description	Upgrades	Project Status
1	1901 farmhouse	Weatherization Moisture mitigation Heating, spot and whole-house ventilation Appliance replacement	Complete
2	1970s mobile home with addition	Weatherization Moisture mitigation Spot ventilation	Complete
3	1960s doublewide mobile home over foundation	Weatherization Spot ventilation Carpet removal Radon fan Appliance replacement	In progress
4	1978 mobile home and addition	Weatherization Heating and spot ventilation Carpet removal Appliance replacement	Complete
5	1978 ranch	Whole-house ventilation Carpet removal	In progress
6	1800s farmhouse	Weatherization Moisture mitigation Spot ventilation Appliance replacement	Compete

In addition to the six participating patients, one patient was deferred from the program due to hoarding. This patient continues to receive support from NVRH with the goal of future re-enrollment in the program.

Three patients dropped out of the program. One patient was in very poor health, one patient was in a substandard living situation (rented seasonal camp, no running water) and one patient sold the home.

All four of these patients received weatherization, efficiency upgrades, and health coaching to the extent possible within existing programs outside the scope of the pilot.

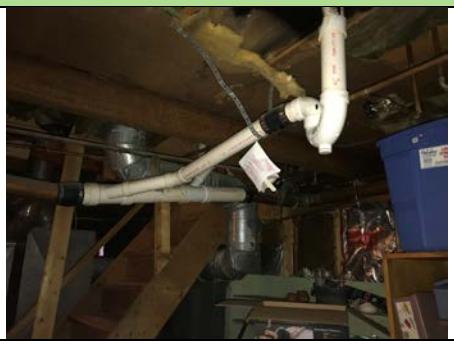
Home 1:	1901 farmhouse on a rubble foundation, additions on poured concrete foundation
Occupancy:	2 adults, 2 children, 2 dogs
Energy + health opportunities	• Basement dampness • Need for wall and attic air sealing and insulation • Rodent activity • Inefficient wood stoves, water heater, and freezer • Faulty gas stove / oven • Musty carpet in office • Clutter and trash throughout • Lead paint • Two dogs sleeping in patient bedroom
Completed scope of work	• Trash hauling • Basement moisture management • Air sealing and insulation • Heating system cleaning and ducting improvements • Replaced gas cooking stove with electric stove • Replaced wood stove with high-efficiency pellet stove • New freezer, lighting, and heat pump water heater • Installed HRV with MERV 13 filtration
Additional services provided	• Housecleaning • Green cleaning supplies and recipes • Wedge pillow for improved breathing • Mattress cover and pillow covers • HEPA vacuum and replacement bags • HEPA air purifier for the bedroom
Lessons learned & challenges:	• Lead program funding dried up and has not been renewed, so the lead scope of work was not compled. • Homeowner does not routinely use HRV – feels that the air is fresh enough. • Patient died mid-project due to co-morbidity, but the project was completed for the benefit of the patient's spouse and other family members living in the home.

Before	After
	

Home 2:	1970s mobile home with 2005 addition on pilings
Occupancy:	1 adult, 1 dog, 1 bird, 3 cats, several fish
Energy + health opportunities	• Insufficient bathroom ventilation, light mold and high CO2 levels • Plumbing leak inside home • Moisture + pest concerns, air sealing and insulation opportunities in crawlspace • Comfort and energy cost concerns during winter • Well pump halfway in crawlspace, caused home to be open to outdoors
Completed scope of work	• Envelope air sealing and insulation completed during previous NETO project • New bath fan and smart switch • Crawlspace poly and insulated skirting install • Well pump moved fully inside building envelope • Dryer re-vented to exterior
Additional services provided	• Green cleaning supplies and recipes • Wedge pillow for improved breathing • Mattress cover and pillow covers • HEPA vacuum and replacement bags • HEPA air purifier for the bedroom
Lessons learned & challenges:	• Limited air sealing, insulation, moisture management, ductwork opportunities that are cost effective on mobile homes. Patient more comfortable but still has concerns about high cost of heating fuel. • Client communication is complex around new products and chemical sensitivies • Importance of ongoing reinforcement for using new products and modifying behaviors with patient, family members, caretakers.

Before	After
	

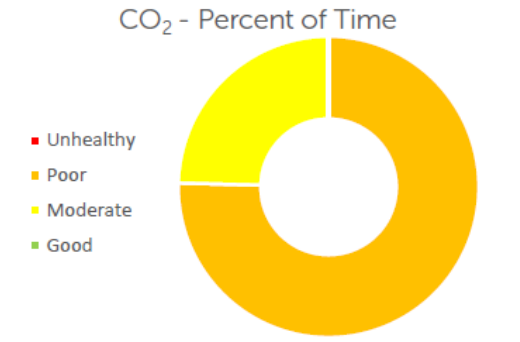
Home 3:	1960s doublewide mobile home on unfinished basement
Occupancy:	2 adults, 1 child
Energy + health opportunities	• Old carpet throughout living areas and bedroom • No kitchen ventilation, no working bath fan • Need for basement and attic air sealing and insulation; comfort concerns during winter • Elevated basement radon • Atmospherically vented water heater
Completed scope of work	• Carpet removal and hard surface flooring install • Air sealing and insulation • Furnace cleaning and ducting improvements • Replaced bath fan with timer and added kitchen ventilation • New on-demand propane water heater • Improved bulkhead door <u>To be completed:</u> • Radon ventilation
Additional services provided	• Already had dust mite covers and green cleaning supplies. • Declined new vacuum, and air purifier, and wedge pillow.
Lessons learned & challenges:	• Patient hospitalized long-term partway through project. Weatherization scope of work completed but Efficiency Vermont has been unable to return to the home for follow up IAQ testing and to facilitate installation of radon mitigation system. • Hard surface flooring presented fall risk for patient who was used to the old non-slip carpeted floor. Coaching on wearing slippers with sticky tread was important. • Unable to convince patient to use HEPA vaccuum or air purifier.

Before	After
	

Home 4:	1978 mobile home and addition on half basement
Occupancy:	2 adults
Energy + health opportunities	• Need for air sealing and insulation • No range hood • Furnace broke during cleaning • Old refrigerator, dehumidifiers, wood stove • Old carpet throughout home
Completed scope of work	• Carpet removal and hard surface flooring install • Furnace replacement • New refrigerator, dehumidifier, wood stove <u>To be completed:</u> • Replace bath fan and add range hood • Improve bulkhead door • Air sealing and insulation
Additional services provided	• HEPA vacuum • Green cleaning supplies and recipes • HEPA air purifier for the bedroom
Lessons learned & challenges:	• Concerns about patient safety loading woodstove while using oxygen. All partners worked with patient to offer the option for a pellet stove with automatic feed or removing wood heat entirely. Patient unwilling to switch away from cord wood (gets it from neighbor for low cost), so a new EPA certified woodstove was the best and safest replacement option.

Before	After
	

Home 5:	1978 ranch on basement
Occupancy:	2 adults, 1 dog
Energy + health opportunities	• Carpet throughout living areas and bedroom • High humidity throughout home, suspected mold growth on windows • High CO_2 levels
Completed scope of work	• Prior NETO air sealing/insulation and heat pump water heater install • Carpet removal and hard surface flooring install <u>To be completed:</u> • HRV install
Additional services provided	• Wedge pillow for improved breathing • Mattress cover and pillow covers • HEPA vacuum and replacement bags • HEPA air purifier for the bedroom • Green cleaning supplies and recipes
Lessons learned & challenges:	• Limited pipeline of contractors to deliver ventilation retrofits and those that do are very busy, creates timline challenges.

Before	After
 Bedroom CO2 levels, April 2019	HRV install in progress

Home 6:	1800s farmhouse
Occupancy:	1 adult
Energy + health opportunities	• No range hood • High CO levels from gas range/oven • Significant air sealing and insulation opportunities • Moisture concerns in basement
Completed scope of work	• Range hood install • New gas range/oven • Bath fan install with timer controls • New sump pump and poly on basement floor • New bulkhead door • Air sealing and insulation in attic, walls, basement, crawlspace
Additional services provided	• Wedge pillow for improved breathing • Mattress cover and pillow covers • HEPA vacuum and replacement bags • HEPA air purifier for the bedroom
Lessons learned & challenges:	• Paticipant attached to cooking on gas stove, happy to replace with new gas stove but did not want to switch to an electric stove.

Before	After
	

Springfield Area: SMCS and SEVCA

Pilot process

The Springfield area pilot mirrors the Northeast Kingdom pilot in program design with a focus on severe COPD and uncontrolled asthma[14]. (See Northeast Kingdom: NVRH and NETO for a detailed process description.) The Springfield partners include the SMCS Community Health Team community health workers, SEVCA and Efficiency Vermont.

Initially, the Springfield pilot was limited to asthma patients and did not include COPD as SMCS was using funding from the VDH to target uncontrolled asthmatics with in-home care. Once the VDH funding ended, SMCS Community Health Team requested to expand the pilot to include COPD patients thereby increasing the eligible patient population. At that time, the partners fully aligned the Springfield and Northeast Kingdom pilot programs.

Both the Northeast Kingdom and Springfield health teams received initial training on healthy homes and in-home self-managed care coaching for respiratory disease by Efficiency Vermont and Rutland Regional Medical Center. NVRH received a repeat training for healthy homes in 2019 after adding new staff to the pilot program.

Additionally, both collaboration teams initiated the pilots with a kick-off meeting with all stakeholders present to walk through the program process and fine tune the procedures and communication details. Both teams met twice a month initially, reducing to once a month once the pilots were up and running and communication was well established. Annually, each team reassessed progress-to-date and discussed program improvements to ensure program success. These annual kick-offs were important for making the space to think through patient recruitment and program design elements. Having the respective annual meetings within the same month allowed for communication of lessons learned between the two pilot programs via the common partners – Efficiency Vermont and VT OEO WAP. Additional finetuning of procedures occurred during the monthly check-in calls.

Springfield area pilot participants

By the end of 2019, one patient participated in the Springfield area pilot with SMCS and SEVCA as summarized in Table 2.

Table 2: Springfield area pilot participants

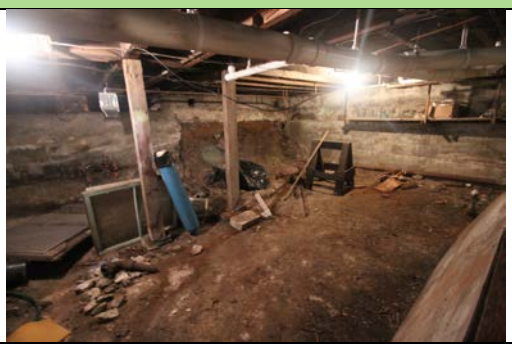
Home	Description	Upgrades	Project Status
1	Late 1800s duplex	Weatherization Moisture mitigation Heating and spot ventilation Appliance replacement	In progress

[14] Defined as 1+ unscheduled emergency/urgent care visits in past 12 months for asthma or COPD acute exacerbation, 2 or more per year primary office visits for asthma or COPD symptoms, and/or 2 or more refills of rescue inhalers in last 12 months.

In addition to the single participant, one patient was deferred from the program because the patient was unwilling to remove items from basement to allow for necessary weatherization work to proceed.

Another patient dropped out of the program because of concerns that home improvements would lead to property tax increases, despite coaching explaining that property taxes would not change based on the proposed scope of work. This patient continues to receive health coaching to the extent possible within existing programs outside the scope of the pilot.

Home 1:	Late 1800s duplex on stone basement
Occupancy:	2 adults in upstairs apartment, 1 adult (patient) in downstairs apartment
Energy + health opportunities	• Moisture concerns in basement • Comfort concerns in bedroom • High electric bills due to air conditioning and dehumidification in summertime • High fuel bills for wintertime heating
Completed scope of work	<u>To be completed:</u> • Bath fan install with timer controls • Poly on basement floor • New bulkhead door • Air sealing and insulation in attic, walls, basement, crawlspace
Additional services provided	• Mattress cover and pillow covers • Green cleaning supplies and recipes
Lessons learned & challenges:	• Participant is legally blind and unable to manage paperwork or appointments. The support of family members that live in an appartment upstairs has been essential to project progress.

Before	After
	Work in progress

Champlain Valley: UVM Medical Center and CVOEO

Pilot process

Participants are referred into the fall prevention pilot through two channels:

1) CVOEO screens customers during the energy coaching visit using the One Touch referral survey and home walk-through. Eligible and interested customers are registered.
2) A UVM Medical Center Community Health Improvement nurse receives referrals or patients at risk of trips and falls at home through the pre-existing Fall & Fires Prevention Home Safety Program. The referrals come from health care providers at the UVM Medical Center and from the One Touch referral survey delivered by CVOEO. The Community Health Improvement nurse then conducts an initial home trips/falls hazard assessment and screens patients for eligibility for the pilot program. Where patients are homeowners (or renters with cooperative landlords) and meet WAP income eligibility (below 80% AMI), the nurse assists participants to complete the WAP application.

   CVOEO confirms WAP eligibility and schedules a walkthrough of the home. In consultation with the participant.

In both channels, CVOEO and the Community Health Improvement nurse identify energy-plus-health opportunities for the home.

When appropriate, program partners support participants to coordinate additional social service offerings.

Efficiency Vermont manages the pilot, coordinating services as needed between partner organizations. UVM Medical Center and CVOEO/Vermont WAP pay for supplies and repairs.

The Community Health Improvement nurse conducts pre- and post-project health surveys to monitor changes in fear of trips/falls and quality of life. When the participant lives outside of the service territory for the Community Health Improvement nurse, VDH conducts the surveys and provides coaching by phone. CVOEO tracks pre- and post-project energy use.

Champlain Valley pilot participants

By the end of 2019, 11 patients participated in the Champlain Valley pilot with UVM Medical Center and CVOEO as summarized in Table 3.

Table 3: Summary of Champlain Valley falls pilot participants

Home	Description	Upgrades	Project Status
1	1960s mobile home	Weatherization Falls prevention	Complete
2	1980s mobile home	Weatherization Falls prevention	Complete
3	1970s ranch	Weatherization Falls prevention	Complete
4	1980s ranch	Weatherization Falls prevention	Complete
5	1980s mobile home	Weatherization Falls prevention	Complete
6	1920s Victorian	Weatherization Falls prevention	On hold – electrical issues
7	1970s ranch	Weatherization Falls prevention	On hold – away for winter
8	1880s farm house	Weatherization Falls prevention	In progress
9	1990s raised ranch	Weatherization Falls prevention	In progress
10	1970s ranch	Weatherization Falls prevention	In progress
11	1820s cape	Weatherization Falls prevention	In progress

One patient was deferred from the program due to the patient feeling there was too much else going on in the patient's life at the present time to fully participate in the pilot. This patient continues to receive support from partners with the goal of future enrollment in the program.

An example of the fall prevention measure checklist used by CVOEO's energy coaches is provided in Figure 1. An example photo documenting where a specific measure is to be installed is provided in Figure 2. Figures xx-xx showcase example installed measures.

Recommended Fall Prevention Measures for Home

Measure	Number Needed	Notes
Doorbell install		Provide details. May require subcontractor if wireless transmitter is not acceptable.
Flooring repair		
Handrail & hardware - install		
Handrail repair	2	one cellar stairs one front steps
Step/stair repair		Provide details. May require subcontractor if complex.
Light bulbs*		
Light fixture repair		Provide details. May require subcontractor if permit is required.
Lighting fixtures install		Provide details. May require subcontractor if permit is required.
Lighting motion sensor		
Lights: Chain extension to ceiling fans and lights		
Lights: Clapper*		
Lights: Night Light*	1	in bathroom
Shower: Dual Shower Head/Hand Held*		
Shower: Tub slip resistant strips*		
Shower: Seat*		
Shower: Non-skid bath mat*	1	
Toilet: Raised toilet seat*		
Grab bar install	2	one by toilet over window one by tub
Other		

* Indicates installed by Energy Coach

Figure 1: Example fall measures checklist

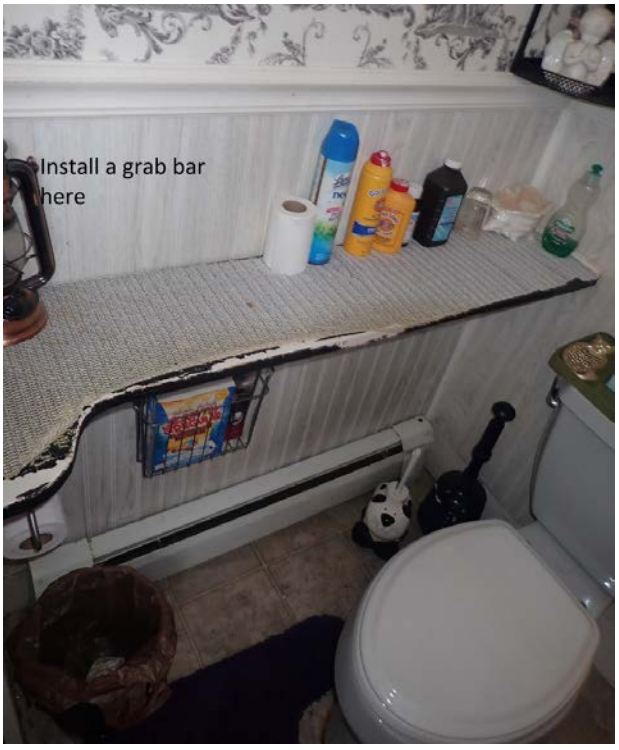


Figure 2: Example photo showing placement of fall prevention measure for installation

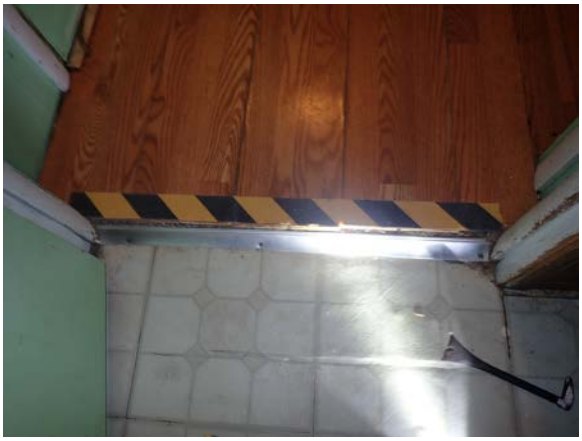


Figure 3: Example threshold with marking to catch the eye and angle added to smooth transition

Figure 4: Grab bar and shower stool

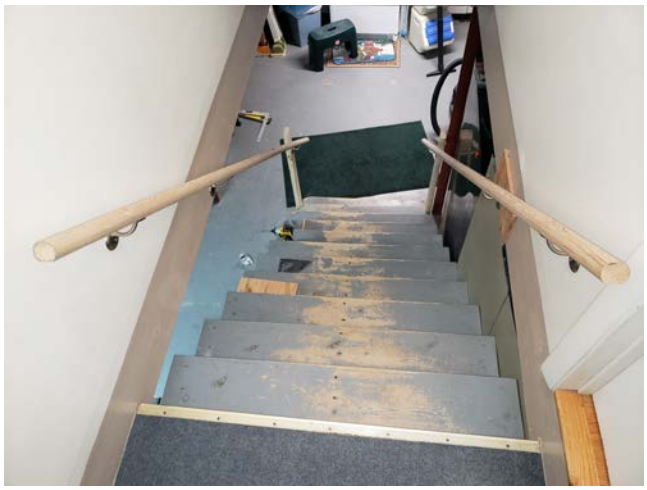


Figure 5: Double handrails added to basement stairs

Conclusions: Promising Early Results

The collaboration has gained valuable experience from the pilots thus far and categorizes these lessons in to “easy wins” and “confirmed challenges” as follows.

Easy Wins
Hospital community health teams have incredibly talented and committed staff with strong patient relationships. Community health worker involvement in the pilots has proven essential for achieving positive patient outcomes and hitting pilot goals. The health teams have provided strong participant referrals and valuable program improvements and are driven to ensure pilot success. In-depth patient relationships and experience with self-managed care coaching supports the identification of realistic, participant-customized plus health measures.

Likewise, the weatherization auditors, energy coaches and crews have fully embraced the pilot goals and take initiative in delivering the energy-plus-health services. The auditor and coaches’ local community knowledge, experience with the customer population and training in healthy home essentials have increased program efficiency.

The fall prevention pilot proved to be the easiest to integrate into the existing weatherization service offering requiring minimal training, time and costs. Customer engagement has been seamless for the energy coaches and repairs are relatively simple for the crews.

Open and candid communication between the collaboration partners has enabled ongoing program improvements and quick problem solving.

Confirmed Challenges
The asthma and COPD pilots have proven more challenging both in customer engagement and in retrofit implementation. The NVRH team relaxed participant requirements regarding severity of asthma and COPD in order to recruit enough participants. This change will impact program cost effectiveness.

Co-morbidity in older participants and challenges with changing behaviors highlight the critical role for the health worker in coaching participants, care givers and frequent home visitors throughout the process.

Households have widely varying levels of cleaning perceptions and habits. While in-home asthma triggers are well known and treatments are proven with the potential for patients to be cured, environmental treatments for COPD are in the discovery stage and COPD is not curable.

Complexities in service coordination across community social service programs outside of the core partnership collaborative have prolonged project cycles and

required substantial project management resources. Braiding in outside resources has been susceptible to staff turnover and funding reprioritization independent of the pilot program.

All team members have competing priorities and regular check-ins support everyone in managing project progress. Tracking residential air quality and energy-related health outcomes is relatively new to the energy sector and each require a specific skill set and tools - fortunately, there are national networks available to support these efforts. Air quality monitoring in the respiratory pilots has provided useful information for identifying underlying air quality issues and prioritizing retrofits.

Looking Ahead

The pilots are succeeding in establishing Vermont-specific experience with energy-plus-health program collaborations. Partner relationships are stronger as a result of the pilots, leading to new program designs and increased cross-referrals outside of pilot programs. Early air quality testing results and customer surveys provide encouraging results indicating improvements in indoor living environments and participant quality of life.

The initial pilot findings and results show promise for patient health improvements and increased program collaboration in addressing energy-plus-health needs of low-income Vermonters.

The partners plan to conduct energy-plus-health retrofits on four more Northeast Kingdom homes, nine more Springfield area homes, and four more Champlain Valley homes. Patient recruitment will continue through doctor referral, Front Porch Forum, and other outreach tactics. All partners have agreed to continue the program through 2020, pending availability of funds, and to discuss long-term program potential once all results are evaluated at the end of the year.

Additionally, Efficiency Vermont is designing a fourth pilot that provides referrals from health care providers to Efficiency Vermont services for patients without income eligibility requirements to test the potential for free energy-plus-health walk-throughs and indoor air quality monitoring to encourage customers to complete energy efficiency projects and modify behaviors. The Healthy Home Energy Visit referral pilot will also evaluate the value of the information collected during these walk-throughs to the referring health care provider.