Health Benefits of Residential Energy Efficiency

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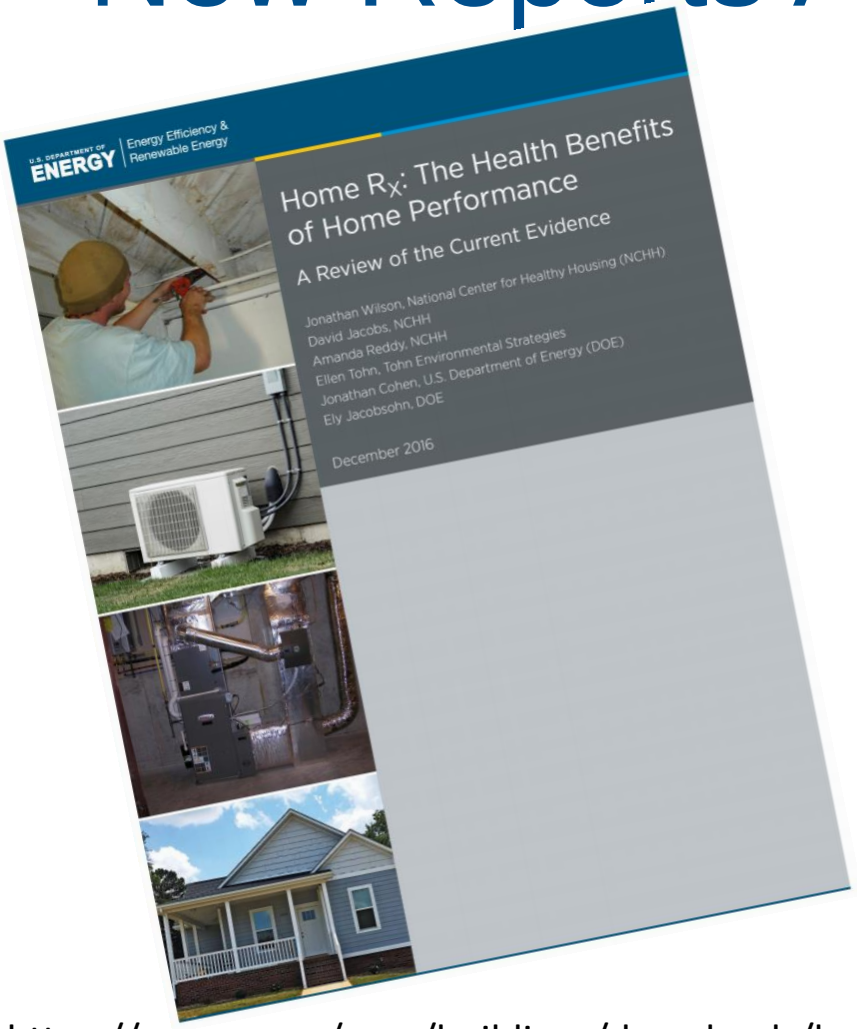
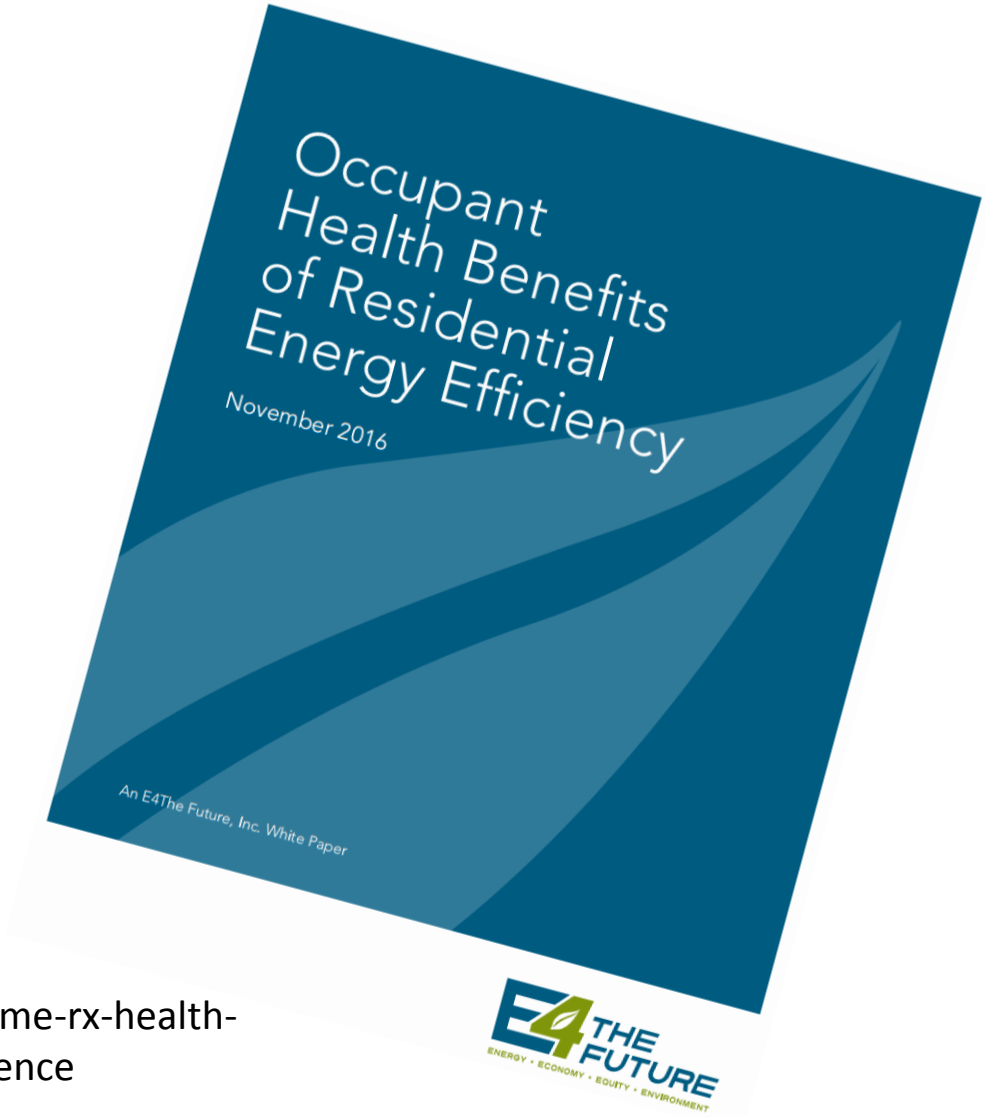
New Reports Available





https://energy.gov/eere/buildings/downloads/home-rx-health-benefits-home-performance-review-current-evidence

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https://e4thefuture.org/wp-content/uploads/2016/11/Occupant-Health-Benefits-Residential-EE.pdf

Literature Review Overview

- **Goal**:
  - Investigate impact of home performance measures on resident health
- **Objectives**:
  - Build the case for contractors and home performance advocates so they can:
    - ➢ Educate home performance clients
    - ➢ Educate current funders (utilities, DOE)
    - ➢ Educate medical community

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Studies Considered

- 40 Studies met criteria for inclusion
  - Base energy efficiency: 6
  - Enhanced energy efficiency: 7
  - Green construction: 9
  - Ventilation: 8
  - Supplemental Services: 10

    (Room air cleaners, wood stove replacement, gas stove replacement)

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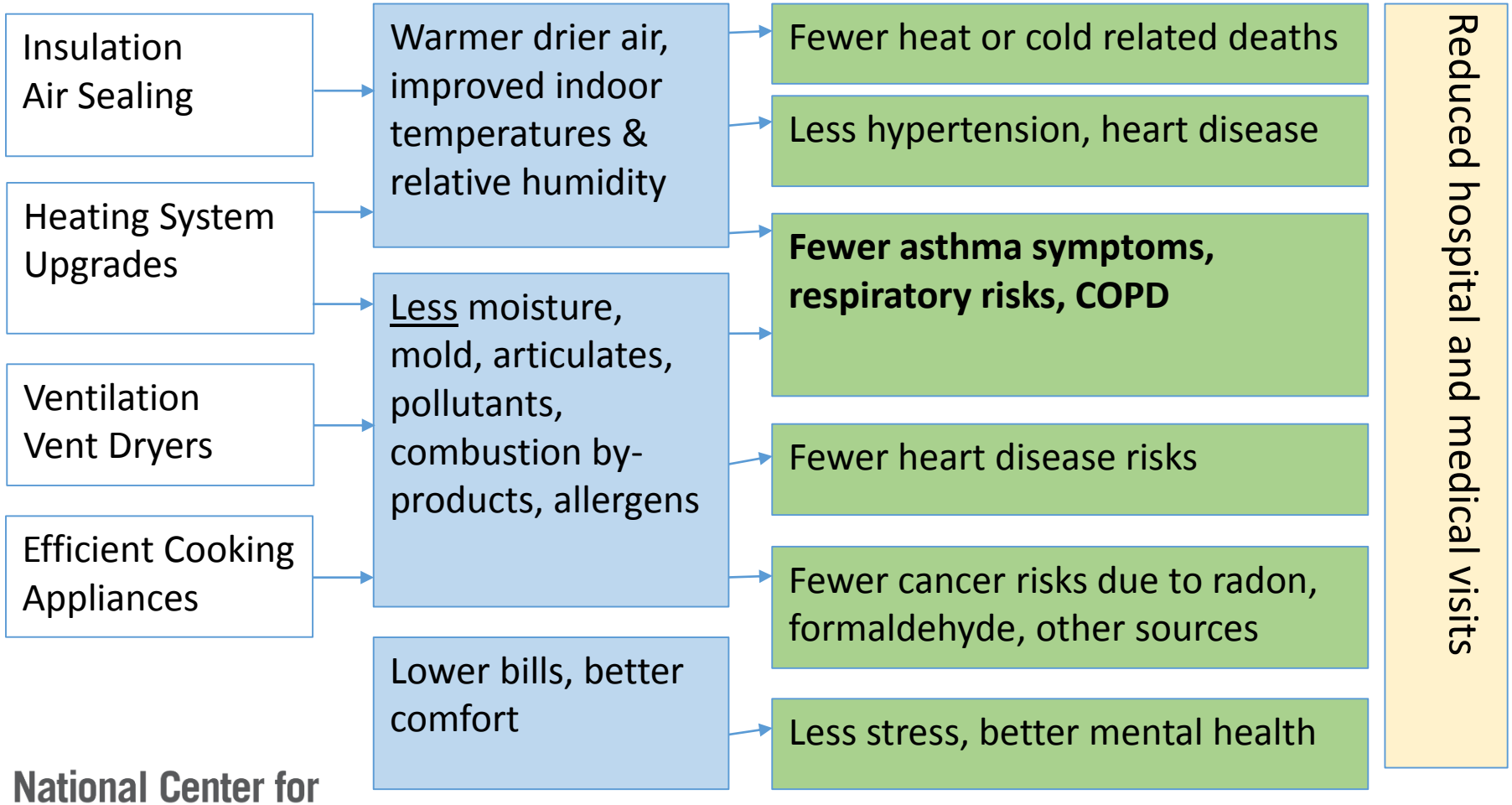
How energy efficiency can reduce health risks



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Observed Effects

Reduced Respiratory & Allergy Symptoms	Other Health Improvements	Reduced Emergency Dept. Visits or Hospitalizations	Indoor Environmental Conditions
Allergies	Headaches	Asthma	Moisture
*Asthma**	Hypertension	Other respiratory	Condensation
Colds	Thermal stress		VOCs
Sinusitis	Overall health		*Formaldehyde*
Throat irritation	Mental health		*Radon*
Wheeze			

Italics: some negative outcomes VOCs: Volatile Organic Compounds

* The majority of studies reported asthma improvements; one study documented mixed results

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Documented Health Benefits of Energy Efficiency

- Occupants experience fewer respiratory-related Emergency Department visits after energy efficiency (EE) (National Evaluation of WAP)
- Occupants report better control of their asthma (Breysse)
- Occupants report better physical and mental health after EE (multiple studies)

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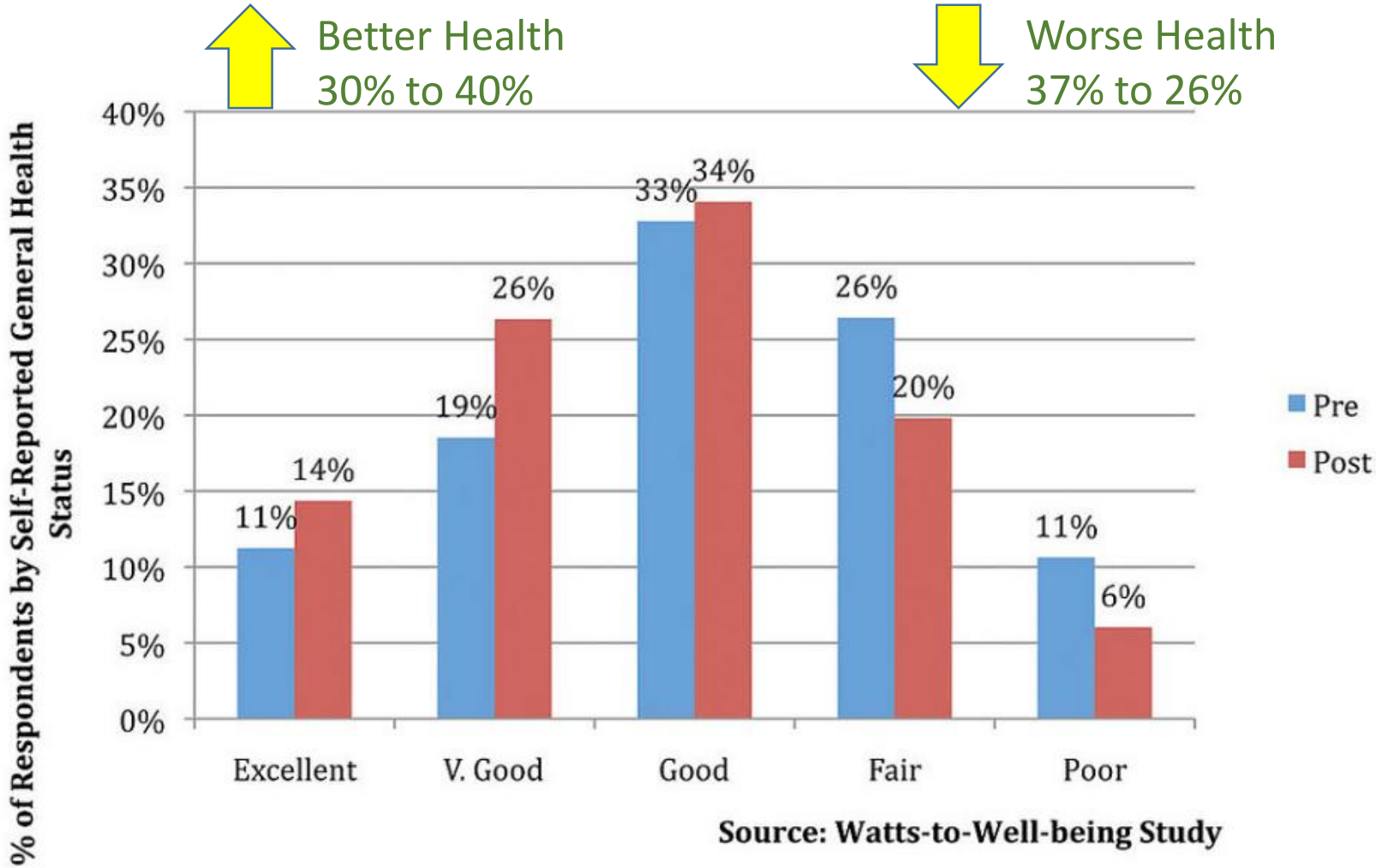
EE = Health Improvements



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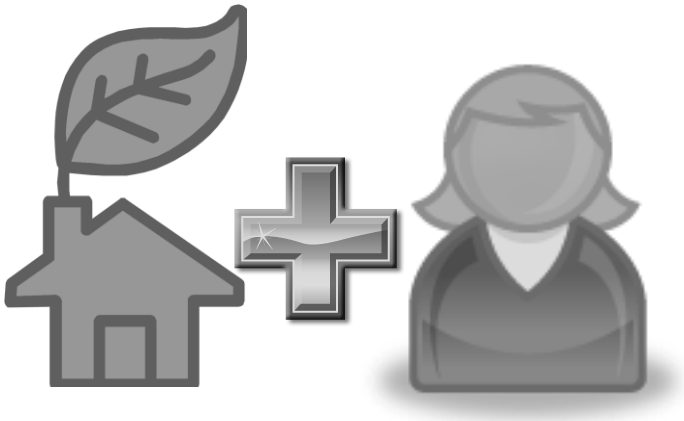
Source: Wilson J, Dixon SL, Jacobs DE, Breysse J, Akoto J, Tohn E, Isaacson M, Evens A, Hernandez J (2014). Watts-to-Wellbeing: does residential energy conservation improve health? *Energy Efficiency*, 7(1), 151.

Weatherization "Plus"

Highline Communities, King County, WA

STUDY GROUP:
WEATHERIZATION PLUS
COMMUNITY HEALTH
WORKER



COMPARISON GROUP:
COMMUNITY HEALTH
WORKER ONLY

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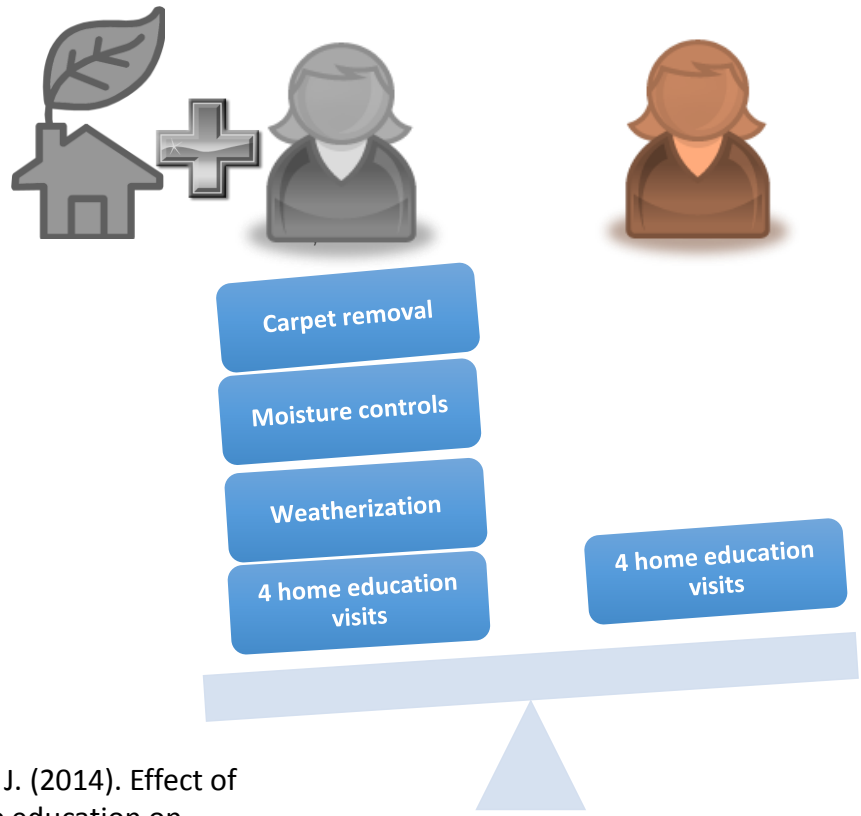
Examples of Services Provided

- Standard weatherization +
- 61% new bath fans - most with timer
- 61% carpets removed
- 26% vapor barriers in crawl space
- 24% kitchen range fans
- Other measures as needed
- $4200/apartments (11)
  $6300/duplex or homes (23)



Source: Breysse J, Dixon S, Gregory J, Philby M, Jacobs DE, Krieger J. (2014). Effect of weatherization combined with community health worker in-home education on asthma control. *American Journal of Public Health*, 104(1), 57.

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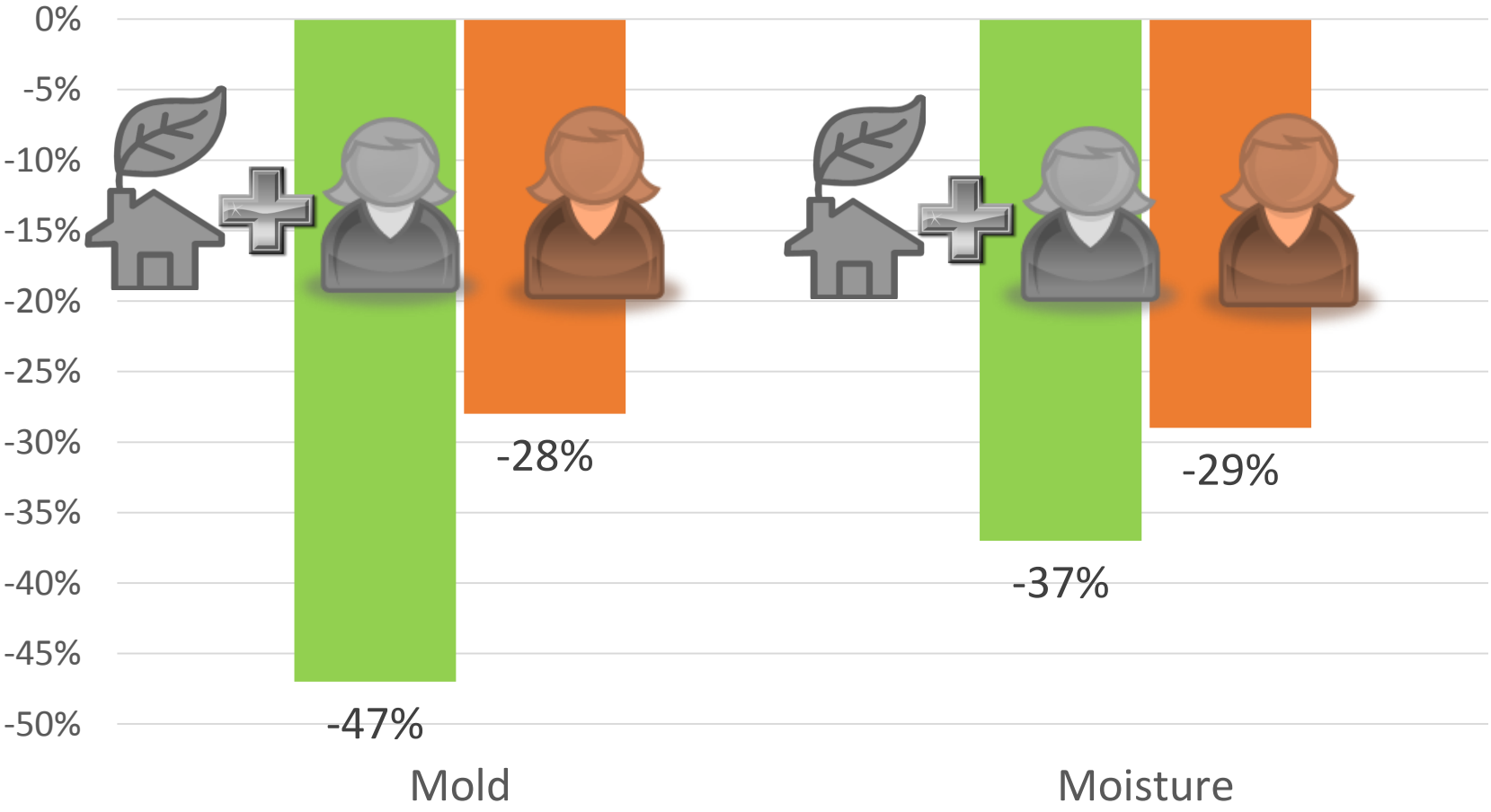
Study Outcome:
Changes in Mold and Moisture



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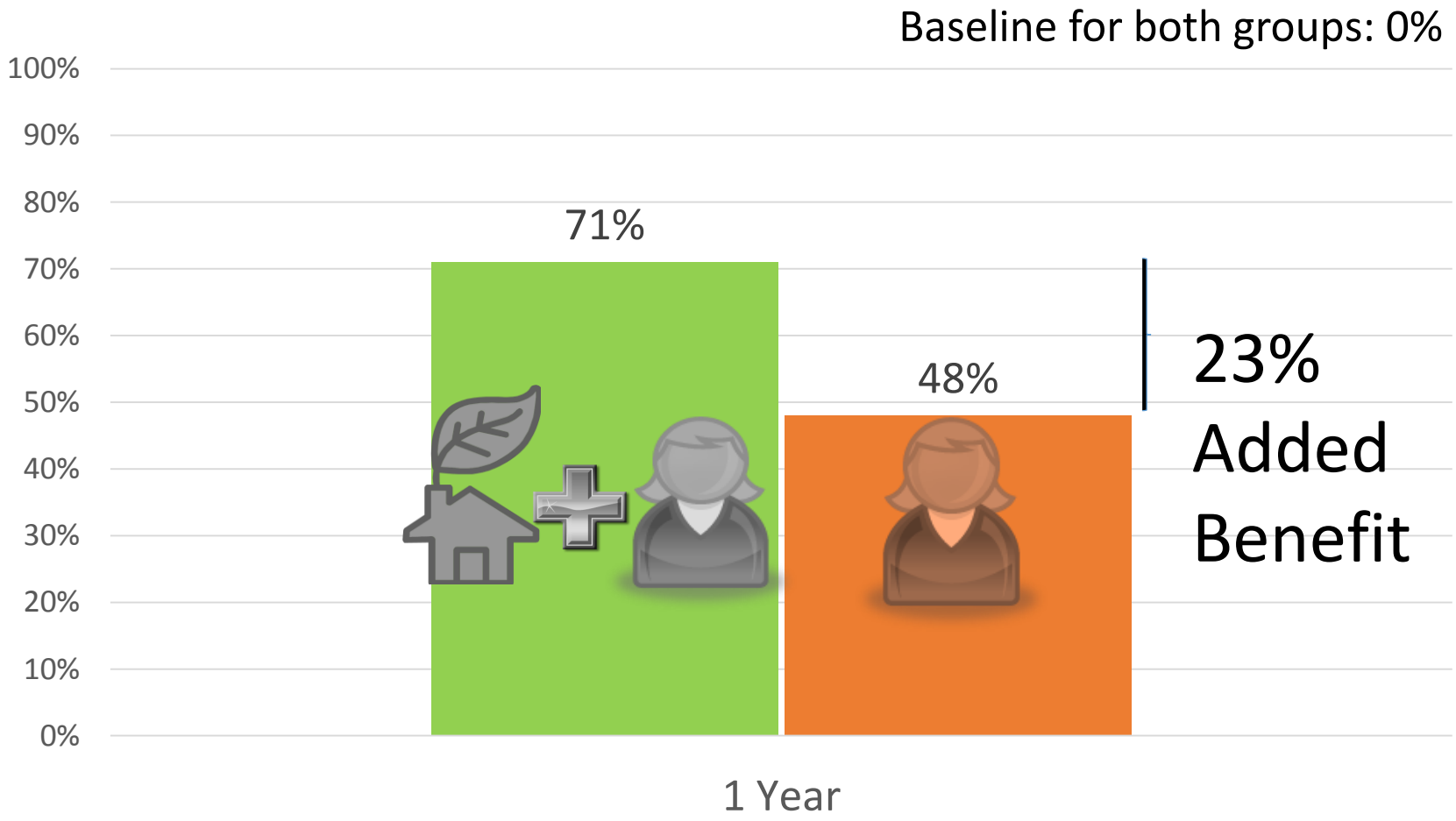
Study Outcome: % of Children with Well-Controlled Asthma



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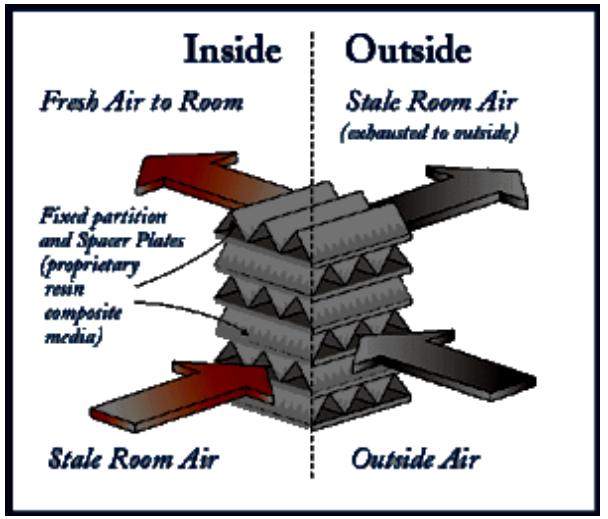
Ventilation

- Eight studies of ventilation systems were considered
- Indoor environmental conditions generally improved with enhanced ventilation
  - Asthma triggers
  - Mold
  - Volatile Organic Compounds
  - *Nitrogen dioxide increased*
- Installation of whole-house ventilation associated with lower dust mite levels

HRV/ERVs

- Installation of HRV/ERVs associated with fewer asthma respiratory symptoms



- 3 studies – all controlled trials with at-risk children or children with asthma
- Studies also observed improvements in CO_2, VOCs, and airborne mold

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Exhaust Ventilation

- Installation of exhaust ventilation to meet 62.2-2010 associated with fewer headaches among children when compared to 62.2-1989
- Homes in both groups had lower CO_2 and formaldehyde levels after work
- Homes in a second study also observed reductions in radon after installation of exhaust ventilation

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Additional Research Needs

- Studies of healthcare utilization
- Studies focused on residents who have a pre-existing respiratory health condition would enhance the research base
- Studies of work in market-rate housing
- Studies of environmental outcomes when health effects take time to be observed
  - Also, studies should better document the practices used by the energy efficiency contractors

Take Home Message

- Consumers want improved comfort and better health; it is a key marketing opportunity
- Multiple studies find that residents feel better, have fewer respiratory symptoms, and experience fewer headaches after energy efficiency measures
- The health effects are supported by IAQ changes
- No one should use this research to guarantee health effects for any particular client, but the evidence is clear that population health benefits are real

Formal Health Related NEB Assessments

Table 5: Examples of Annualized Per Unit Household Health Related Co-Benefits

Estimate ($/unit/year)	Source
$3 - $100; typical $16.50	Skumatz 2014
$27 – limited income insulation/duct sealing	MD 2015 (Potomac Edison, 2015)
$10.46 – low income weatherization $50.32 – low income heating system retrofit/replacement	MA 2011 (Oppenheim 2016; MA Technical Reference 2016)
$937 – low income	MA 2016 under consideration (NMR & Three[3] 2016) [discussed below]

Source: E4theFuture, *Occupant Health Benefits of Residential Energy Efficiency*, 2016.

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Estimated Benefits of Weatherization

Table 7: Avoided Deaths, Hospitalizations, ED Visits, and Physician Office Visits Annually for Each Health-Related NEI, Per 1000 Units Weatherized

NEI	Deaths	Hospitalizations	ED Visits	Physician Visits
Asthma symptoms	-	9.9 (adult) 4.2 (child)	54.6	-
Cold-related thermal stress	0.05	1.9	7.6	9.5
Heat-related thermal stress	0.01	1.1	23.6	3.2
CO poisoning	0.004	0.07	0.47	-
Fire Injury	0.0087	0.013	0.4	0.25

Source: E4theFuture, *Occupant Health Benefits of Residential Energy Efficiency*, 2016.
(from ORNL report of Health Effects of Weatherization Assistance Program)

NMR/Three^3 Reported NEBs

Household NEI W/ Avoided Death Benefit	Annual Per Unit Benefit ($)
Reduced asthma symptoms (medical)	10
Reduced cold-related thermal stress (medical/lives)	463
Reduced heat-related thermal stress (medical/lives)	146
Fewer missed work days (income)	149
Reduced use of short-term, high-interest loans	5
Reduced CO poisoning (5- year life) (medical/lives)	37
Increased home productivity from improved sleep	38
Reduced home fires (medical/lives/property)	94
TOTAL	**$942**

Value is $225/year/unit if value of life excluded

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Questions: Contact Jonathan Wilson – jwilson@nchh.org

Thanks to Ellen Tohn of Tohn Environmental Strategies.

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