

# Evaluating the Health Benefits of Weatherization

Bruce Tonn, PhD.  
Erin Rose, MSSW  
Beth Hawkins, MSLA  
Brian Conlon

Oak Ridge National Laboratory and Three<sup>3</sup>, Inc.

# OUTLINE

- Overview of Weatherization Assistance Program (WAP)
- Methods Used to Monetize Health Benefits
- Selected Results
- Conclusions



# What is WAP?

- The Weatherization Assistance Program is the largest residential energy efficiency program in the U.S.
- U.S. Department of Energy (DOE) provides grants to states and territories based on funding formulas
- States provide grants to local weatherization agencies for free service delivery

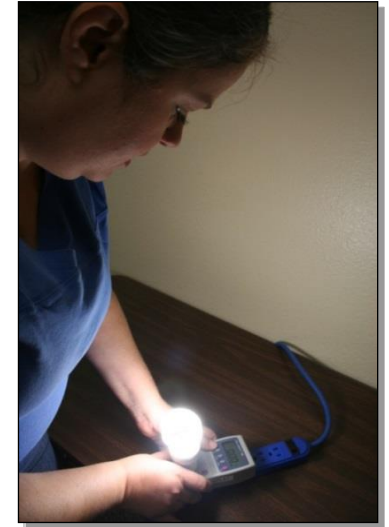
**It's purpose, as established by law, is:**

*“...to increase the energy efficiency of dwellings owned or occupied by low-income persons, reduce their total residential energy expenditures, and improve their health and safety, especially low-income persons who are particularly vulnerable such as the elderly, the persons with disabilities, families with children, high residential energy users, and households with high energy burden.”*



# WAP Services

- Energy efficiency measures need a savings to investment ratio (SIR) of 1.0 or greater
- Per unit spending limits mean that sometimes measures with a  $SIR > 1.0$  are not installed
- Typical Weatherization Measures Installed Include
  - Air Sealing: Attics, doors, windows
  - Insulation: Attics, walls, rim joists
  - Ducts: sealing, insulation
  - Furnace: Tune-up, repairs





# WAP Services

- **Health and Safety Measures**
  - **Combustion Appliances: Furnace, Water Heater, Stove/Oven, Dryer**
  - **Moisture Management: Kitchen and Bathroom Ventilation, Dryer Vents**
  - **Lead Safe Weatherization**
- **Health and Safety measures are subject to limits identified in each state WAP Plan (15% per job is the rule of thumb)**



# Two Approaches to Monetizing Health & Household-related Benefits

- 1) Based on survey data pre- and post-wx with a comparison group (e.g., preventing thermal stress)
- 2) Based on measures installed and known impacts on health (e.g., installing CO monitors)
- Health costs drawn from two U.S. national databases: Medical Expenditure Panel Survey (MEPS) and Health Cost and Utilization Project (HCUP)
- Value of a life saved - \$7.5 million
- Present value of health benefits calculated over 10 years using federally approved discount rates

# **TIERS – These Benefits Group By Strength of Data and Methodology**

- **Tier One** contains the estimates with the relatively highest accuracy, which at the very least are based on observed survey results and do not have any major methodological issues.
- **Tier Two** contains estimates that may be based on observed survey data but have one or two methodological issues and/or be based on strong programmatic observations (e.g., installation of carbon monoxide monitors) but not on direct reports of health change.
- **Tier Three** contains the estimates that some may deem as the most speculative.

# Monetized H&HHD Benefits of WAP (Tier #)

- Reduced Thermal Stress on Occupants: Heat and Cold (T1)
- Reduced Asthma-Related Healthcare and Costs (T1)
- Fewer Missed Days at Work (T1)
- Reduced Need for Food Assistance (T1)
- Reduced Use of High Interest, Short-Term Loans (T2)
- Increased Ability to Afford Prescriptions (T2)
- Increased Productivity at Work Due to Improvements in Sleep (T3)
- Increased Productivity at Home Due to Improvements in Sleep (T3)
- Reduced Heat or Eat Choice Dilemma Faced by Pregnant Women (T3)
- Reduced Carbon Monoxide Poisonings (T2)
- Reduced Home Fires (T3)



# Indoor Thermal Stress: Reduced Incidences

*In the past 12 months, has anyone in the household needed medical attention because your home was too cold or too hot?  
(National Occupant Survey from WAP evaluation)*

Sample Group	Too cold	Too hot
Pre-Weatherization Treatment	3.2%	2.4%
Post-Weatherization Treatment	1.5%	1.5%
Post-Weatherization Comparison	2.1%	1.1%*
<b>Rate of Reduced Incidences</b>	<b>1.4%</b>	<b>1.1%</b>

- N = # of incidences avoided
- Type of medical treatment: a = hospitalization, b = emergency department (ED) visit, c = Physician visit:

***N (a, b, c) = [(number of weatherized units completed in PY 2008) \* (decreased rate of seeking medical care) \* (% of type of medical treatment (a, b, c))]***

***Benefit = [N (a, b, c) \* (average total medical costs - out-of-pocket and payments by Medicaid, Medicare, and other insurance)]***

# Indoor Thermal Stress: Reduced Incidences

## Input

Number of single family and mobile homes weatherized (2008): **80,352**

Decreased rate of seeking medical care: Cold exposure, **1.4%**; Heat exposure, **1.1%**

Type of treatment sought for cold-related illnesses\*

Hospitalizations = **10%**, ED visits = **40%**, Physician Visits = **50%**

Type of treatment sought for heat-related illnesses\*

Hospitalizations = **4%**, ED visits = **11.5%**, Physician visits = **84.5%**

Total **out-of-pocket medical costs** paid (mean) -- treatment of cold-related illnesses\*\*

Hospitalization = **\$87,428**; ED = **\$53,918**; Physician Office Visit = **\$12,509**

Total **out-of-pocket medical costs** paid (mean) -- treatment of heat-related illnesses\*\*

Hospitalization = **\$15,944**; ED = **\$104,030**; Physician Office Visit = **\$2,263**

Total medical costs **paid by insurance** (mean) -- treatment of cold-related illnesses\*\*

Hospitalization = **\$977,146**; ED = **\$193,740**; Physician Office Visit = **\$64,339**

Total medical costs **paid by insurance** (mean) -- treatment of heat-related illnesses\*\*

Hospitalization = **\$189,228**; ED = **\$361,802**; Physician Office Visit = **\$11,640**

\* Medical Expenditure Panel Survey- (MEPS): <http://meps.ahrq.gov/mepsweb/>

\*\*Healthcare Cost and Utilization Project – (HCUP): <http://www.ahrq.gov/research/index.html>.

# Monetization of Benefits - Reducing Indoor Thermal Stress on Occupants

Cold-Related Illnesses				
	First Year Per Household Benefit	PV Per Unit Benefit Over Ten Years	First Year Program Benefit	PV Program Benefit Over 10 years
<b>Households</b>	\$1.91	\$19.04	\$153,854	\$1,530,119
<b>Society</b>	\$15.37	\$152.88	\$1,235,225	\$12,284,587
<b>Total</b>	\$17.29	\$171.93	\$1,389,079	\$13,814,706

Heat-Related Illnesses				
	First Year Per Household Benefit	PV Per Unit Benefit Over Ten Years	First Year Program Benefit	PV Program Benefit Over 10 years
<b>Households</b>	\$1.52	\$15.13	\$122,236	\$1,215,668
<b>Society</b>	\$7.00	\$69.64	\$562,669	\$5,595,870
<b>Total</b>	\$8.52	\$84.77	\$684,905	\$6,811,538

# Indoor Thermal Stress and Mortality

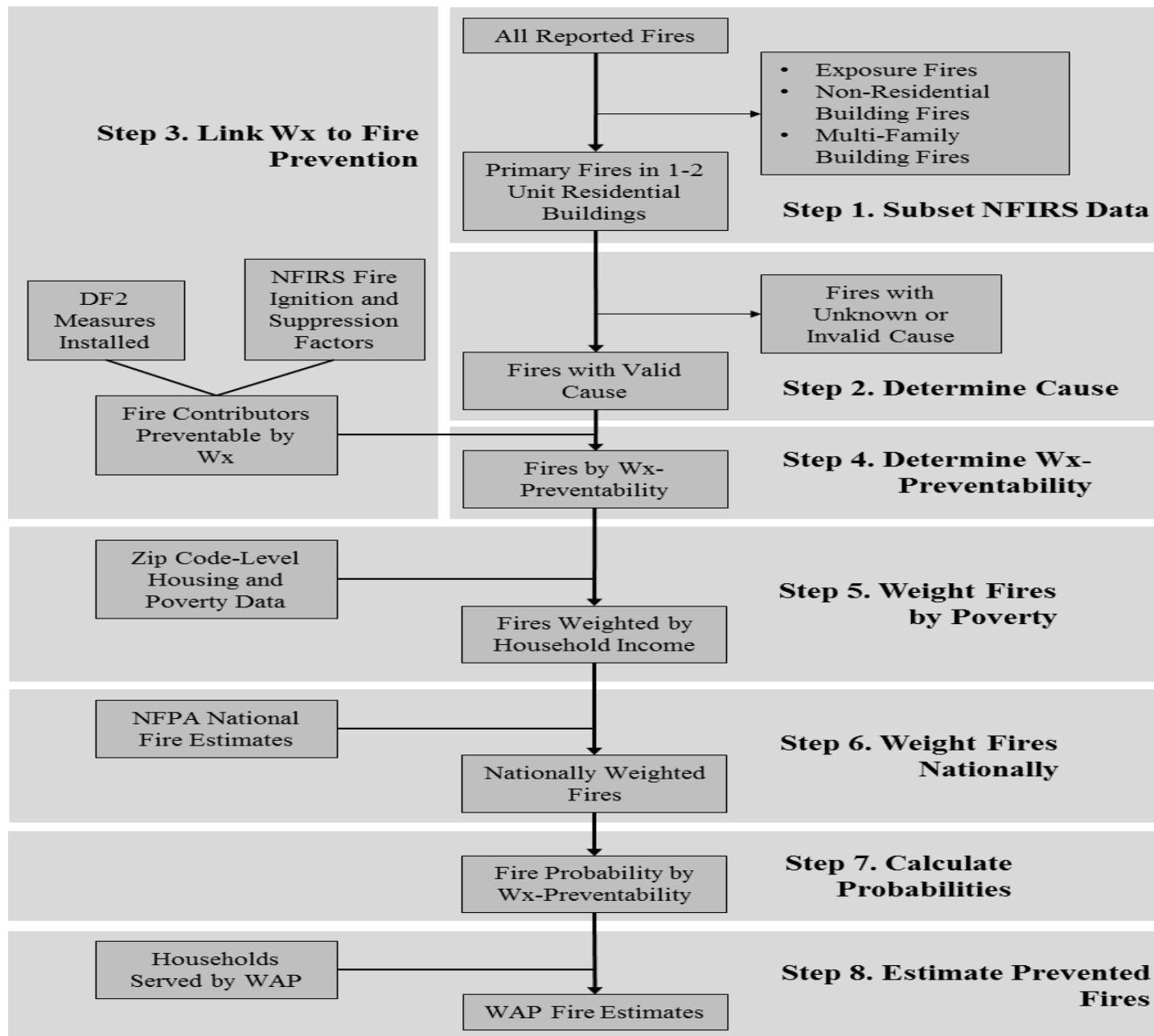
**Deaths due to extreme thermal stress can be prevented through weatherization.**

**# of lives saved** =  $[(\% \text{ of hospitalizations resulting in deaths (U.S. population)} * (\# \text{ of hospitalizations prevented by WAP in PY 2008})]$

**Benefit** =  $\# \text{ of lives saved by WAP} * \text{Value of Human Life}$

- % of hospitalizations due to thermal stress resulting in deaths (U.S., 2008) – 4% (cold); 2% (hot)
- Number of hospitalizations prevented (WAP, PY 2008) – 113 (cold); 35 (hot)
- **Number of lives saved (WAP, PY 2008) - 4 (cold); 1 (hot)**

Non-Energy Benefit (Present Value per Household)	Total	Total (Value of Life Excluded)	Societal	<b>Household</b>
Thermal Stress-Cold	\$3,911	\$172	\$3,892	<b>\$19</b>
Thermal Stress- Hot	\$870	\$85	\$855	<b>\$15</b>





<b>Fire Equipment Ignition and Suppression Factors Categories</b>	<b>Relevant Wx Measures</b>	<b>Weighted Wx Homes in PY 2008</b>	<b>Percent of Wx Units</b>	<b>WAP Weighted NFIRS Fires</b>	<b>Percent of Fires</b>
<b>EI1</b>	Electrical	4,324	5.38%	8.85	2.96%
<b>EI2</b>	Heating	39,128	48.70%	10.76	3.60%
<b>EI3</b>	Cooling	4,969	6.18%	1.54	0.51%
<b>EI4</b>	Clothes Dryer	16,086	20.02%	6.18	2.07%
<b>EI5</b>	Refrigerator	11,918	14.83%	0.80	0.27%
<b>EI6</b>	Water Heater	44,340	55.18%	2.53	0.85%
<b>EI7</b>	Chimney	2,176	2.71%	1.88	0.63%
<b>EI8</b>	Fans	11,205	13.94%	1.38	0.46%
<b>EI9</b>	Lighting	51,556	64.16%	1.52	0.51%
<b>No EI</b>	No EI1-EI9	1,399	1.74%	263.40	88.14%
<b>SF1</b>	Smoke Alarm	36,619	45.57%	3.14	1.05%
<b>SF2</b>	Windows, Doors	39,805	49.54%	1.29	0.43%
<b>SF3</b>	Ventilation	19,229	23.93%	1.97	0.66%
<b>SF4</b>	Air Sealing	75,673	94.18%	1.28	0.43%
<b>SF5</b>	Wall	25,291	31.48%	2.28	0.76%
<b>SF6</b>	Roof, Attic, Ceiling	51,624	64.25%	6.53	2.19%
<b>SF7</b>	Floor	20,226	25.17%	1.11	0.37%
<b>SF8</b>	Gas	1,061	1.32%	0.47	0.16%
<b>No SF</b>	No SF1-SF8	1,667	2.07%	283.87	94.99%
<b>Total</b>	-	80,352	-	298.84	-

**Table 4.25. Summary Frequency and Monetization of Various Prevented Fire Damages**

Damage	Frequency	Household	Society	Total
WAP Fires	46.99	\$503,800	\$874,843	\$1,378,643
WAP FF Deaths	0.0022	\$0	\$16,791	\$16,791
WAP Other Deaths	0.70	\$0	\$5,278,798	\$5,278,798
WAP FF Injuries	4.64	\$0	\$27,377	\$27,377
WAP Other Injuries	1.64	\$1,563	\$8,130	\$9,693
Total	-	\$505,363	\$6,205,939	\$6,711,302

**Table 4.26. Monetization of Benefits Attributable to Fire Prevention**

Beneficiary	First Year Program Benefit	First Year Per Unit Benefit	PV Program Benefit Over 10 Years	PV Per Unit Benefit Over 10 Years
Households	\$505,363	\$6	\$5,025,946	\$63
Society	\$6,205,939	\$77	\$61,719,426	\$768
Total	\$6,711,302	\$84	\$66,745,373	\$831

# CONCLUSIONS

- **Health and household-related non-energy benefits can be monetized using survey and measure installation data, rates of usage of health-related services, and national costs for health-related services.**
- **Even more accurate estimates could be made using actual household medical costs pre- and post-wx (e.g., in the U.S., private insurance and Medicaid/Medicare records).**
- **There may be a non-energy benefits dividend of braiding weatherization with healthy homes measures.**
- **These and other measures can also improve the resilience of low-income homes to climate change and extreme weather events.**