Promoting Better Health Through Climate Change Mitigation
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Objectives
- Assess health co-benefits of building weatherization strategies
- Estimate potential impacts of weatherization strategies on the health of Vermonters
- Communicate health co-benefits of weatherization to key partners and stakeholders

Introduction
- Weatherization (Wx)
  - Home performance improvement process that addresses energy efficiency issues by way of cost-effective building improvements
- Weatherization + Health (Wx+Health)
  - Prioritizes delivery of health benefits through Wx
- Wx offers household & societal benefits
  - Household: reduces energy expenditures, improves thermal comfort, improves health outcomes, reduces healthcare costs
  - Societal: reduces healthcare utilization, reduces GHG emissions and pollutants, enhances resiliency against effects of climate change
- Vermont’s 2016 Comprehensive Energy Plan
  - Priority: Improve the health of indoor environments and reduce energy bills through improved building weatherization
  - Priority: Reduce negative health impacts expected to occur as a result of climate change
  - Goal: Weatherize 25% of the state’s housing stock (~80,000 units) by 2020
- Vermont Climate Action Commission, 2017
  - Goal: Weatherize 20,000 low-income homes by 2020

Methods
- Conducted a literature review of weatherization strategies and associated indoor environmental quality outcomes and health benefits
- Interviewed key partners to investigate local examples where relevant actions are taking place
- Applied findings, where possible, of evidence and assessment methods to estimate possible health impacts of Wx and Wx+Health within the state of Vermont
- Produced technical documentation of the aforementioned findings
- Produced a clear, concise communication tool for key partner and stakeholder communication purposes

Weatherization Strategies
- **Mechanical**
  - Heating & cooling systems, ducts, pipes, water heater
- **Building Shell**
  - Insulation, air sealing, roof/wall leaks, windows & doors, solar screens
- **Healthy & Safety**
  - Combustion safety, ventilation systems, mold assessment, smoke & carbon monoxide detectors
- **Electric & Resident Education**
  - Energy efficient lighting & appliances, resident education regarding indoor air quality and safe use of any new mechanical equipment
- **Health**
  - Mold remediation, advanced ventilation, lead & radon remediation, pest & dust mite remediation, walk-off mats, floor replacement, accessibility, education

Wx Impacts on Indoor Environmental Quality
- Reduce relative humidity
- Improve temperature control
- Reduce mold
- Improve indoor air quality
- Reduce allergens
- Enhance indoor air quality
- Eliminate pest intrusion
- Energy expenditure savings

Table 1. Health Benefits of Wx and Wx+Health

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>Confidence</th>
<th>Direction of Effect</th>
<th>Related Indoor Environmental Quality Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Health</td>
<td>High</td>
<td>+</td>
<td><img src="image1" alt="Image" /></td>
</tr>
<tr>
<td>Asthma</td>
<td>High</td>
<td>+</td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>Upper Respiratory</td>
<td>High</td>
<td>+</td>
<td><img src="image3" alt="Image" /></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Medium</td>
<td>+</td>
<td><img src="image4" alt="Image" /></td>
</tr>
<tr>
<td>Neurological</td>
<td>Low</td>
<td>+</td>
<td><img src="image5" alt="Image" /></td>
</tr>
<tr>
<td>Infectious Disease</td>
<td>Low</td>
<td>+</td>
<td><img src="image6" alt="Image" /></td>
</tr>
<tr>
<td>Accidental Injury</td>
<td>Low</td>
<td>+</td>
<td><img src="image7" alt="Image" /></td>
</tr>
<tr>
<td>Mental Health</td>
<td>High</td>
<td>+</td>
<td><img src="image8" alt="Image" /></td>
</tr>
<tr>
<td>Productivity</td>
<td>High</td>
<td>+</td>
<td><img src="image9" alt="Image" /></td>
</tr>
<tr>
<td>Financial Stress</td>
<td>High</td>
<td>+</td>
<td><img src="image10" alt="Image" /></td>
</tr>
<tr>
<td>Social Health</td>
<td>Medium</td>
<td>+</td>
<td><img src="image11" alt="Image" /></td>
</tr>
<tr>
<td>Healthcare Utilization</td>
<td>Medium</td>
<td>+</td>
<td><img src="image12" alt="Image" /></td>
</tr>
</tbody>
</table>

Discussion
- Evidence is growing in support of a positive association between weatherization strategies and health benefits
- Evidence is strongest for certain populations of concern
  - Minority populations
  - Households of low socioeconomic status
  - Residents with preexisting chronic health conditions

Recommendations
- Consider standardizing review approach to include emphasis on specific intervention strategies delivered to the study population
- Limit review of health outcomes of concern to those with the highest confidence for improvement due to weatherization
- As studying the connection between weatherization and health is an emerging field, consider using epidemiological literature to draw tighter connections between IEQ outcomes of Wx to health outcomes of interest, as opposed to limiting to only studies that explore connections specifically between Wx and health outcomes
- Consider growing importance of air conditioning or passive cooling as means to combat extreme heat

References

Footnotes
1. While not a direct component of indoor environmental quality, reduced household energy expenditures is a benefit of weatherization strategies intended to collectively improve energy efficiency.

Images:
- (Image1)
- (Image2)
- (Image3)
- (Image4)
- (Image5)
- (Image6)
- (Image7)
- (Image8)
- (Image9)
- (Image10)
- (Image11)
- (Image12)