

Pilot Health Impact Assessment of Climate Change Action Plans in Western Massachusetts

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Acknowledgements

- ☞ CDC Cooperative Agreement funding Health Impact Assessment (HIA) initiatives
 - DPH's work in conducting HIAs on a variety of topics
 - First mandated transportation-related HIA, the built environment, redevelopment of vacant lots, neighborhood revitalization, school buildings, transit-oriented development and broad connections between health and community development activities
- ☞ Stakeholders
 - Springfield
 - Williamsburg
- ☞ Pioneer Valley Planning Commission (PVPC)

Introduction

- ∞ DPH received funding from CDC to conduct Health Impact Assessments (HIAs)
- ∞ DPH climate change capacity survey determined that many communities had variable levels of capacity to address increased frequency and severity of predicted impacts; Regions 1 and 2 recently experienced extreme weather events, change in the distribution of vector-borne risks; significant advances in climate action planning by PVPC, and interest in conducting an HIA in western MA
- ∞ HIA objectives were to:
 - convene municipal stakeholders from two communities to select two climate action strategies to evaluate in the pilot HIA;
 - qualitatively assess health implications of two climate action strategies selected by stakeholders; and
 - recommend tools, innovative methods, and approaches to conduct comprehensive HIAs to more fully explore health impacts and benefits of adaptation strategies.

Factors Responsible for Population Health



Health status is determined by:

Genetics: 20–30%

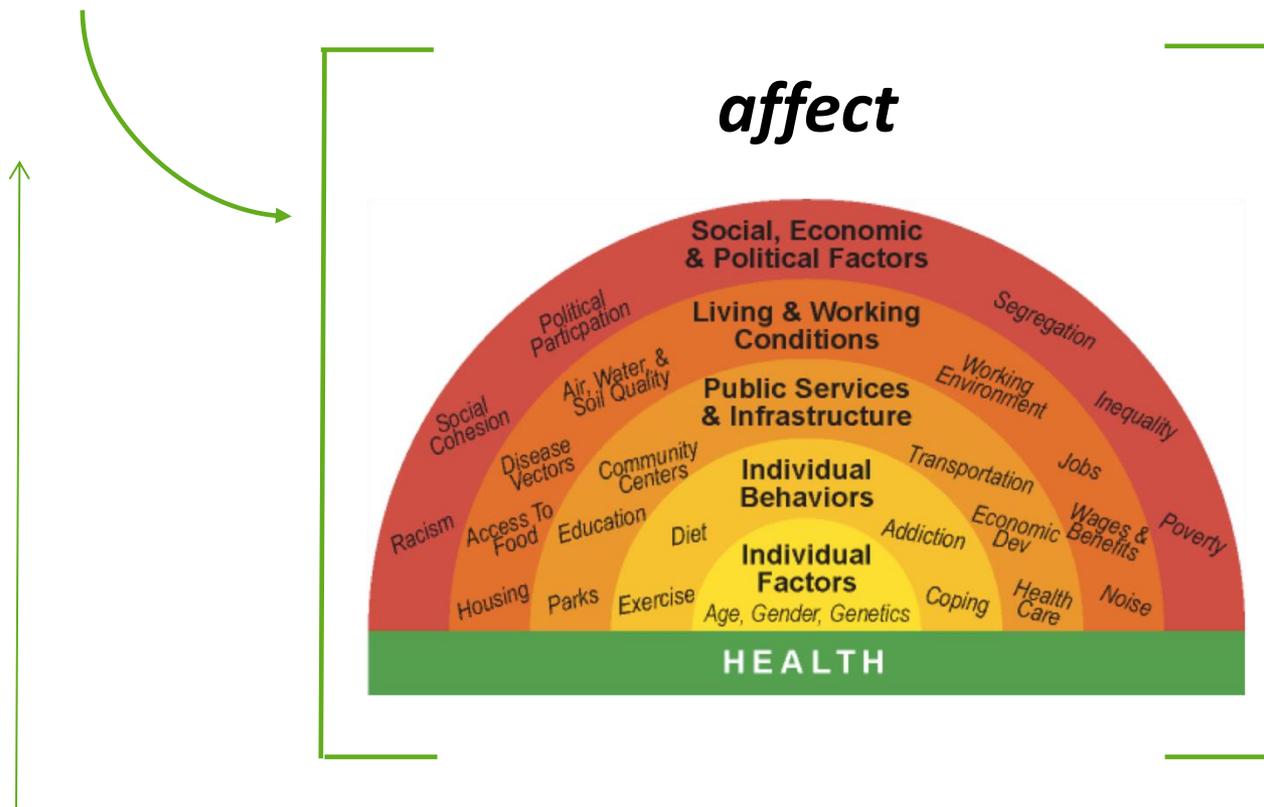
Health care: 10%

Social, environmental conditions, and behavior: 60–70%

J Health Affairs, 2002

HIAs Address Determinants of Health

How does the proposed project, plan, policy



What is a Health Impact Assessment (HIA)?

“A combination of procedures, methods and tools that **systematically judges** the potential, and sometimes unintended, **effects of a policy**, plan, program or project on the **health of a population** and the **distribution of those effects** within the population. HIA identifies appropriate actions to manage those effects.”

Steps of HIA

Screening

- Determines the need and value of a HIA

Scoping

- Determines which health impacts to evaluate, methods for analysis and a work plan

Assessment

- Provides (1) describes baseline health conditions and (2) predicts potential health impacts

Recommendations

- Provides strategies to manage identified adverse health impacts

Reporting and Monitoring

- Tracks the impact on decision-making processes and the decision and the impacts of the decision on health determinants

Screening a Climate Change HIA: Step A

∞ Is there a decision-making point related to climate action appropriate for a HIA?

- Yes! PVPC's "Pioneer Valley Climate Action and Clean Energy Plan (updated in 2013)
- 29 Strategies (49 Supporting Actions)
 - Many focused on *municipal* actions

“Climate action will reduce illness and deaths due to diseases, heat waves, extreme weather events, poor air quality and reduce overall health care costs.” PVPC

Scoping of Pilot HIA

Specific



Generalizable

● Pilot an HIA to inform decisions relating to climate change mitigation and adaptation strategies in Williamsburg and Springfield

● Analyze the connection between climate change planning and health

● Provide an approach for analyzing the connection between climate change planning and health in both rural and urban settings

Scoping

- ✎ Both Springfield and Williamsburg communities participate in MDPH Mass in Motion program and are designated *Green Communities*
- ✎ Convened stakeholder process
- ✎ Two strategies from the PVPC Climate Action Plan were selected by stakeholders from Springfield and Williamsburg :
 1. **Retrofitting municipal buildings for energy efficiency**
 2. **Location and operation of cooling centers**

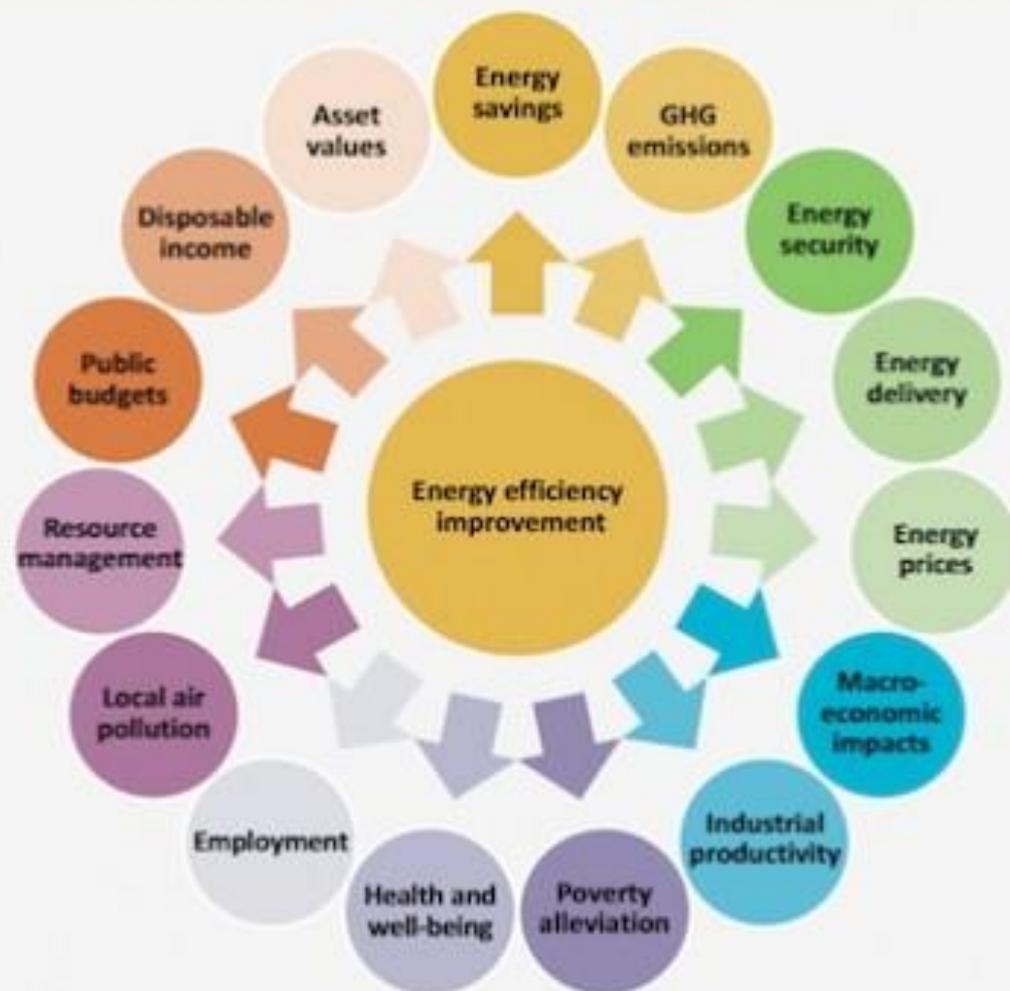
Literature Highlights

Energy Efficiency:

- The assessment of the health co-benefits of energy efficiency programs is an emerging field of study
- Air pollutants and greenhouse gases are released by the same processes (fossil fuel combustion, transportation, agriculture, and industrial processes) so that by mitigating greenhouse gas emissions, levels of air pollution may also be reduced, leading to health co-benefits
- Indoor air quality may be improved by efforts to improve energy efficiency. Improved ventilation and efforts to maintain building HVAC systems for energy efficiency have been shown to improve the health of building occupants, leading to lower rates of worker absenteeism and higher productivity. However, poor ventilation may result in increases in indoor air pollutants (e.g., radon, air pollution from indoor sources).
- Some trade-offs exist between reducing health-damaging air pollutants and reducing greenhouse gases
- Fuel switching to less polluting fuels (e.g. from heating oil to natural gas) reduces emissions from energy use but other aspects related to life cycle of fossil fuel production need also to be considered

Figure 1.1

The multiple benefits of energy efficiency



Notes: GHG = greenhouse gas. This list is not exhaustive, but represents some of the most prominent benefits of energy efficiency identified to date. Source: Unless otherwise noted, all material in figures and tables in this chapter derives from IEA data and analysis.

Key point

A multiple benefits approach to energy efficiency reveals a broad range of potential positive impacts.

Literature Highlights

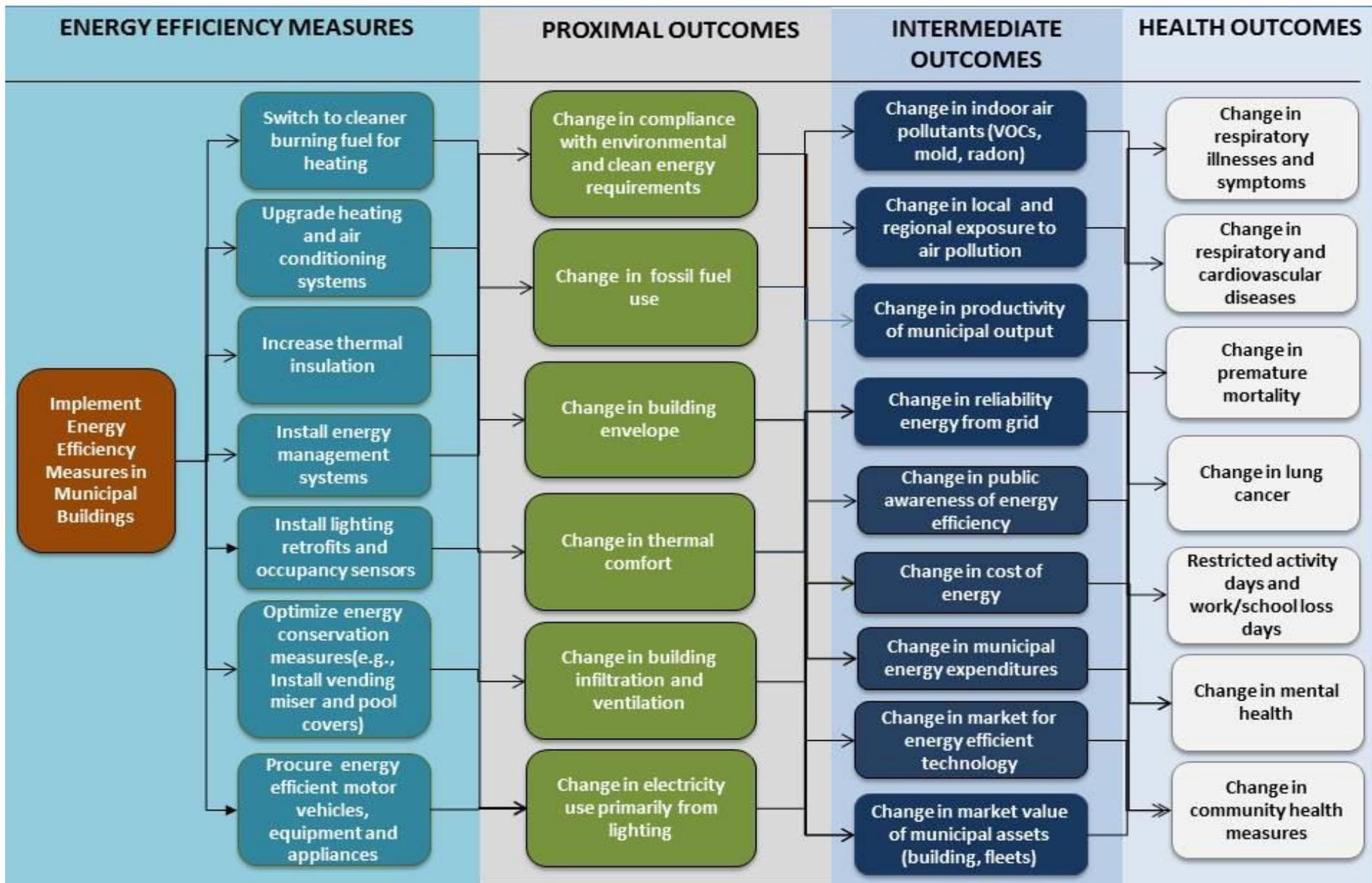
∞ Cooling centers:

- Extreme heat events, or heat waves, are the most common cause of weather-related deaths in the United States. They cause more deaths each year than hurricanes, lightning, tornadoes, floods, and earthquakes combined.
- Since 1970, average annual temperatures have steadily increased by 2 °F in Massachusetts and winter temperatures have increased 5.2 °F over the past four decades
- Climate change models have predicted that the increasing trend will continue with more frequent extreme summer heat. Heat waves are predicted to increase in both the frequency and duration and will occur earlier in the season
- Factors that may increase the vulnerability to heat are pre-existing disease (diabetes), demographic (elderly), socio-economic (poor), and built environment factors (urban heat islands).
- Heat-related death or illnesses are preventable
 - Planning for heat waves can be an effective way to reduce heat-related impacts including develop a heat response plan and coordinate with partners to implement the plan, communicate advice on tips on how to stay cool during a heat wave, establish cooling centers near vulnerable populations, and improve housing and urban planning

Scoping: Research Questions

Category	Research questions
Retrofitting municipal buildings for energy efficiency	<ul style="list-style-type: none">• Do the energy efficiency measures implemented in Springfield and Williamsburg as part of their Green Community certification have health impacts/benefits?• How do these health determinants affect health outcomes such as lung cancer, cardiovascular disease, lung disease, and asthma?• How can municipalities apply savings from energy efficiency programs to improve local health?• Are residents more likely to follow suit with energy efficiency improvements if the town 'leads by example'?• Can efforts to achieve greater energy efficiency in the community impact local and regional air quality?
Location and operation of cooling centers to address increases in frequency, intensity and duration of heat waves	<ul style="list-style-type: none">• How does local planning of cooling centers affect, and how is it affected by, these health determinants?• How do these health determinants affect health outcomes, especially during heat waves?• How can Springfield and Williamsburg improve planning for cooling centers to improve health outcomes, especially for vulnerable populations?

Health Outcomes Associated with Energy Efficiency Measures for Municipal Buildings



Contribution to Municipal, Regional, State, National, and International Mandates and Goals

☞ Municipal level activities

- ESCO work
- Green Communities certification (includes 20% reduction in municipal energy use+)
- Energy/Sustainability/Green committees
- Extreme Heat Planning/Policy

☞ Regional Activities

- Pioneer Valley Climate Action Plan & collaborative implementation

☞ Statewide mandates and program goals:

- GWSA: GHG emission targets and adaptation planning
- Green Communities Act (Designation and Grant Program)
- Low Emission Vehicle Program
- Compliance with NAAQS by energy sector
- Statewide climate preparedness initiatives focused on infrastructure
- Leading by Example

☞ National/International

- National climate plan
- International plan to reduce GHGs

Green Communities Certification (in brief)

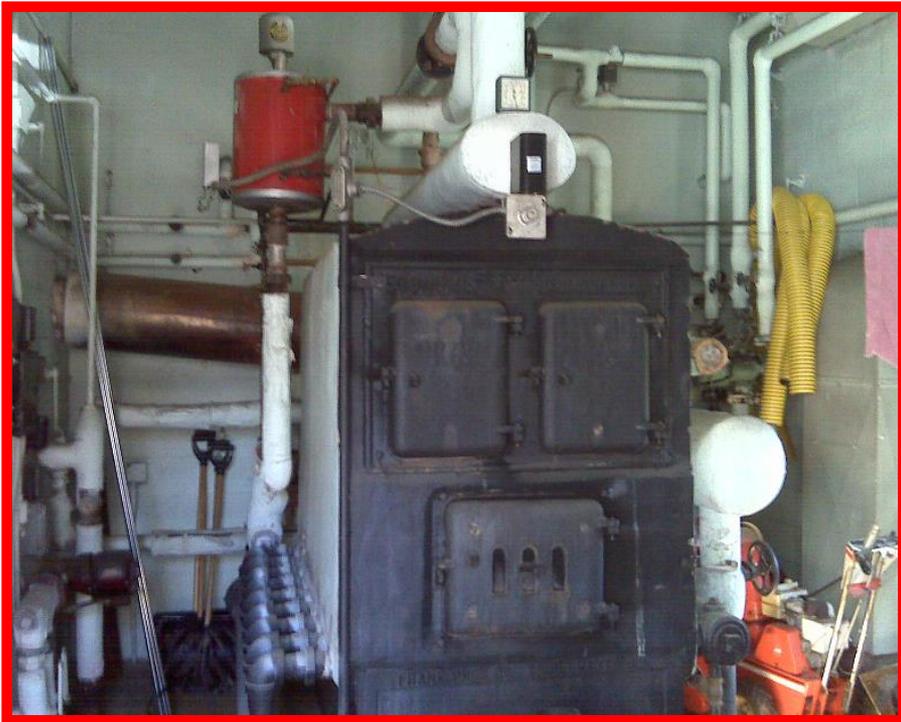
- ∞ Part of the 2008 Green Communities Act included creation of the Green Communities Program
- ∞ An **optional** certification for MA Municipalities
- ∞ Achieve 5 requirements including committing to 20% reductions in municipal energy use over 5 years
- ∞ Receive a min of \$125,000 from state (Springfield received \$1,000,000) with additional competitive funding available
 - → Sample of Municipal level activities
 - Equipment upgrades and Replacement
 - Improvements to Building Envelope
 - Lighting retrofits
 - Energy Management Systems

Energy Efficiency

1. Boiler Replacements
2. Energy Management System Installations
3. Lighting and Sensor Retrofits
4. Pool Cover Installations
5. Motor and Drive Upgrades
6. Radiator Control Valve Installations

Boiler Replacements

BEFORE



AFTER

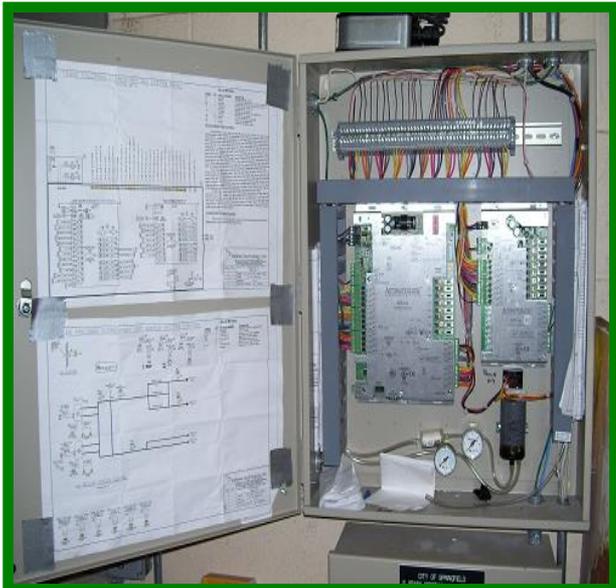


Energy Management Systems



BEFORE

- Old pneumatic systems
- Air leaks, disabled equipment
- Little or no control of heating systems



AFTER

- Electric / Pneumatic system controls
- Remote access to monitor classroom temperatures and HVAC equipment in real-time

Lighting & Sensor Upgrades



BEFORE

- Poor lighting conditions
- Inefficient fixtures wasted energy
- Lights would be left on when building was empty



AFTER

- Improved lighting environment for building occupants
- Improved fixture efficiency and added occupancy sensors will provide energy savings
- Reduced maintenance cost with extended lifetime of new lamps



Building improvements help lower asthma rates

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Sept. 25, 2014

By **G. Michael Dobbs**

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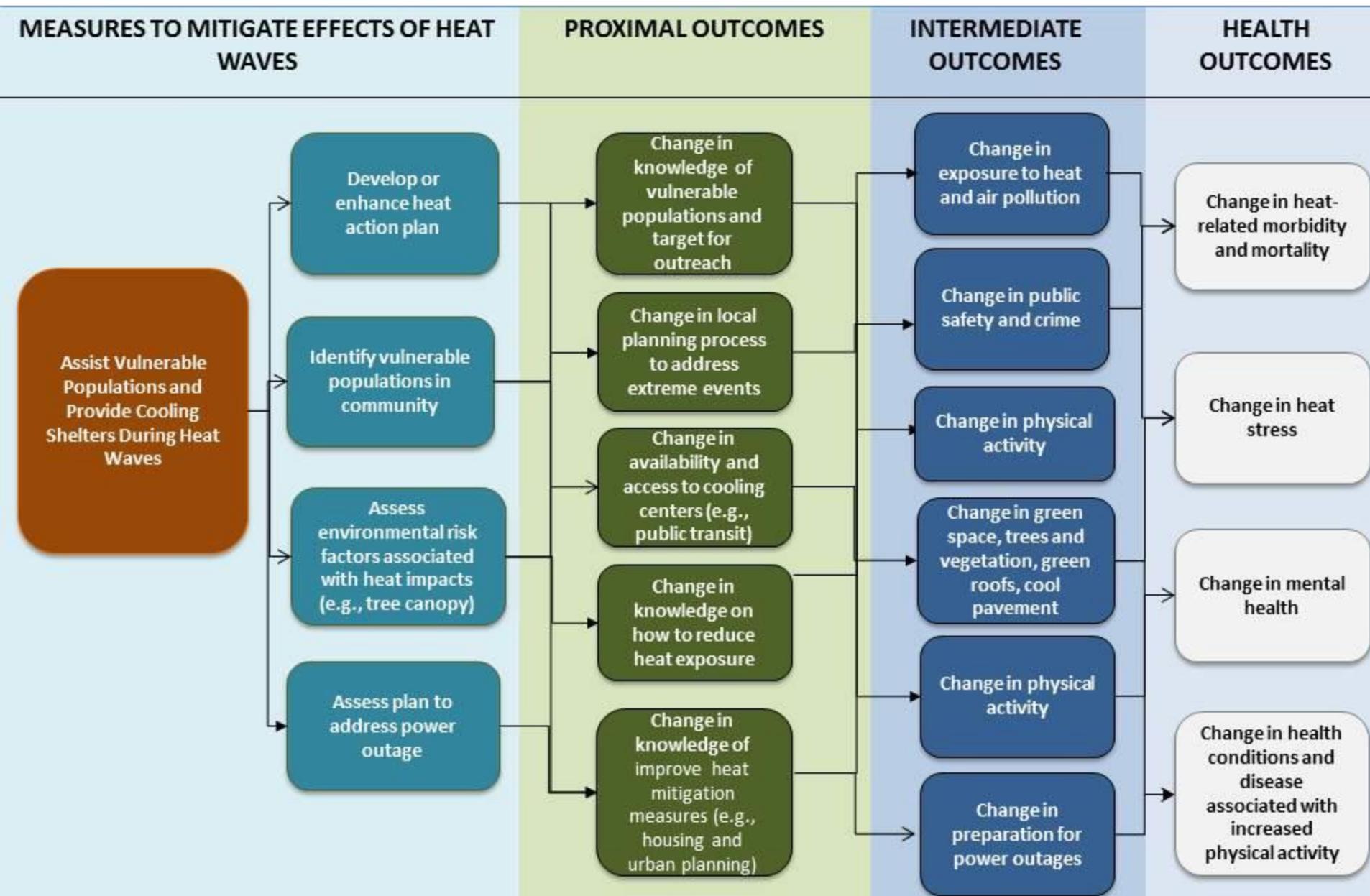
SPRINGFIELD – According to a presentation made at the School Committee meeting on Sept. 18, significant strides have been made in improving the city's school buildings resulting in a 4 percent decrease in the asthma rate among students.

Before a presentation of a report by Executive Director of the Springfield Department of Parks, Buildings and Recreation Management Patrick Sullivan on the buildings, the administrations of both Indian Orchard Elementary School and



While the most visible improvement of the city's school district may be the construction of the new Elias Brookings School, replacing the building damaged by the June 1, 2011

Health Outcomes Associated with Managing Extreme Heat Events



Assist Vulnerable Populations and Provide Cooling Shelters During Heat Waves

- 1. Predicted Change in Exposure To Heat:** Historical and predicted climate modeling data of the projected number of extreme heat days (98th percentile) in Hamden and Hampshire counties of Massachusetts.

Source of Data: Climate change data consisting of modeled temperature data of Daily Downscaled Climate Projections by federal government

- 2. Identification of Vulnerable Populations in Each Community:** Certain populations are more susceptible to increased temperature and may require additional assistance during extreme heat events. EPHT identified the following measures:

- ❑ Age-adjusted estimates of the percentage of adults ≥ 20 years with diagnosed diabetes, 2008
- ❑ All heart disease hospitalization rates among Medicare beneficiaries ≥ 65 years, 2000-2006
- ❑ Percent of population below the poverty line
- ❑ Percent of population of a race other than white
- ❑ Percent of population aged 65 years and over living alone in a non-family household
- ❑ Percent of population ≥ 5 years with a disability

Source of Data: MDPH/BEH, EPHT and MassGIS

Assist Vulnerable Populations and Provide Cooling Shelters During Heat Waves

3. **Change in Local Planning Process to Address Heat: Evaluate existing plans in place to address heat:** PVPC conducted interviews with appropriate staff from each community. This will also include alternative approaches to cooling shelters for people to reduce heat impacts at home.

4. ***Other:***
 - Change in public safety and crime
 - Change in Physical Activity

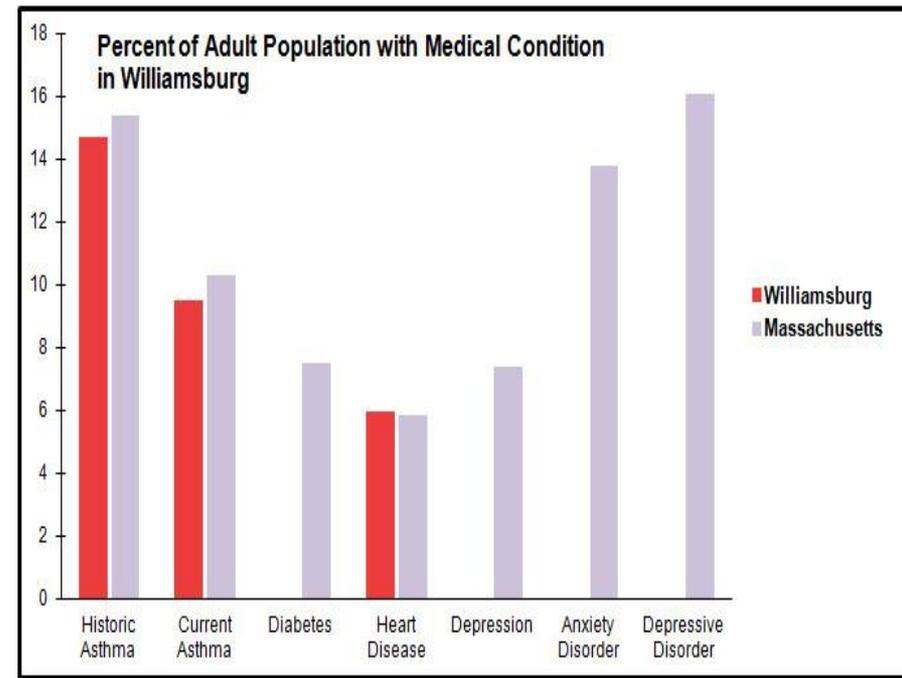
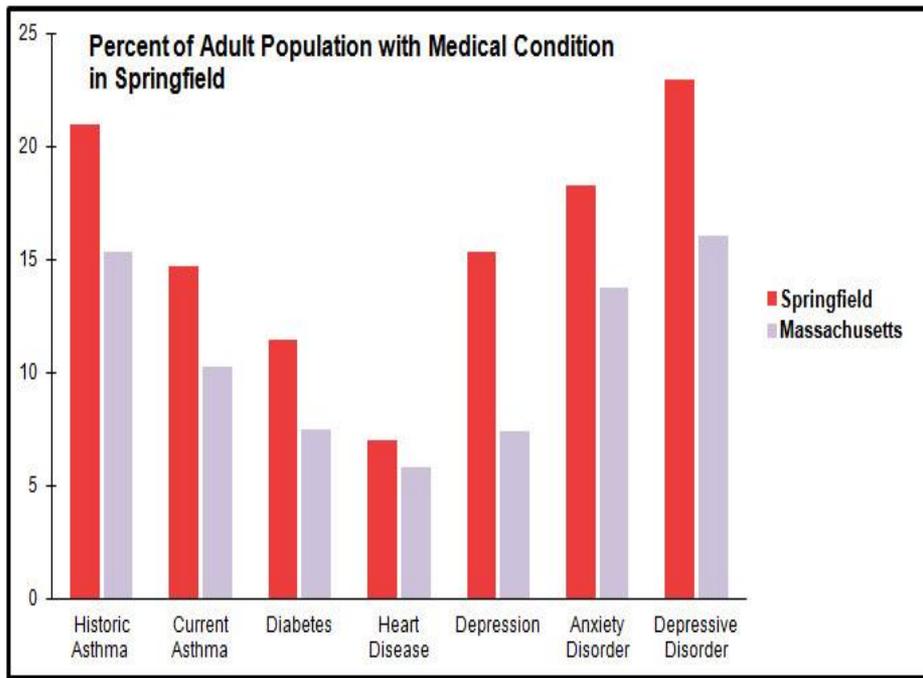
Preliminary Assessment

- ∞ Identified and Assembled Data for:
 - Baseline
 - Health data from DPH:
 - Hospitalization ED Visits and Discharge Data
 - Asthma (All Ages, 14 years and younger)
 - Hypertension
 - Coronary Heart Disease
 - Stroke
 - Mental Health
 - Cancer (SIR)
 - Environmental Data
 - Air Quality
 - **Assessment of Energy Efficiency and Cooling Centers and Health**
 - Projected energy savings from Green Communities program
 - Survey of activities to address need for cooling centers and mapping of vulnerable populations, location of cooling centers,

Example of Assessment of Baseline Conditions

Demographic Characteristics (1)	Statistic	Springfield	Williamsburg	Massachusetts
Population	Total	153,278	2,631	6,560,595
Race	Percent White	51.5		
	Percent Black or African American	21.6		
	Percent Hispanic or Latino (of any race)	39.5		
Income	Median household income	35,163	58,636	66,658
	Per capita personal income	18,016	35,529	35,485

Example of Assessment of Baseline Conditions



Energy Efficiency in Municipal Buildings

Baseline energy use and projected savings from Williamsburg's 20% Energy Reduction Plan (2013)

	MMBtu used in baseline year (2011)	% of total MMBtu baseline energy consumption	Projected planned MMBtu savings	Savings as % of MMBtu baseline energy consumption
Buildings	5417	73	774	14
Vehicles	1537	21	17	1
Street/Traffic Lights	171	2	0	0
Water/Sewer/umping	292	4	0	0
Open Space	5	0	0	0
Total	7422 MMBtu	100%	791 MMBtu	15%

Electricity	Kilowatt hours	16,226	Number of MA homes this could power by electricity	2	Equivalent cars off the road	1
Heating Oil	Gallons	6,792.00	Number of MA homes this could heat by oil	8	Equivalent cars off the road	15
Electricity, Natural Gas, Heating Oil	Total Energy (MMBtu)	1,000.03	Number of MA homes powered AND heated	8		

Energy Efficiency in Municipal Buildings

Projected savings from Springfield's 20% Energy Reduction Plan (2011)

Completed Work	54,603.1 MMBTu
Work In Progress	3,243.2
Future Work	38,003.7
Street Lights	5,050.1
Gasoline Reduction	746.0
TOTAL Projected Savings	101,646.0
Total usage baseline FY07	470,587.5
TOTAL % REDUCTION	21.6%

Electricity	Kilowatt hours	3,575,916	Number of MA homes this could power by electricity	471	Equivalent cars off the road	269
Natural Gas	Therms	276730	Number of MA homes this could heat by natural gas	293	Equivalent cars off the road	310
Heating Oil	Gallons	2,746.00	Number of MA homes this could heat by oil	3	Equivalent cars off the road	6
Electricity, Natural Gas, Heating Oil	Total Energy (MMBtu)	258,010.00	Number of MA homes powered AND heated	2,000		

Change in Local Impacts from Energy Efficiency Actions: Heating Oil

Springfield			
Fuel Type		FY2007	FY2013
	Location	Gallons	Gallons
Heating Fuel Oil	School Buildings	533655.6	44736.3
Heating Fuel Oil	Municipal Buildings	88544.3	26402.9
Heating Fuel Oil	Totals	622199.9	71139.2

	School Buildings	Municipal Buildings	Total (lbs)
PM2.5	1041.4	132.4	1173.8
PM10	1163.6	147.9	1311.5
CO	2444.6	310.7	2755.3
NOX	11734.1	1491.4	13225.5

Change in Local Impacts from Energy Efficiency Actions: Heating Oil

Williamsburg			
		FY2009	FY2013
Fuel Type	Location	Gallons	Gallons
Heating Fuel Oil	School Buildings	19,124.0	14,690.0
Heating Fuel Oil	Municipal Buildings	14,888.0	12,197.0
Heating Fuel Oil	Totals	34,012.0	26,887.0

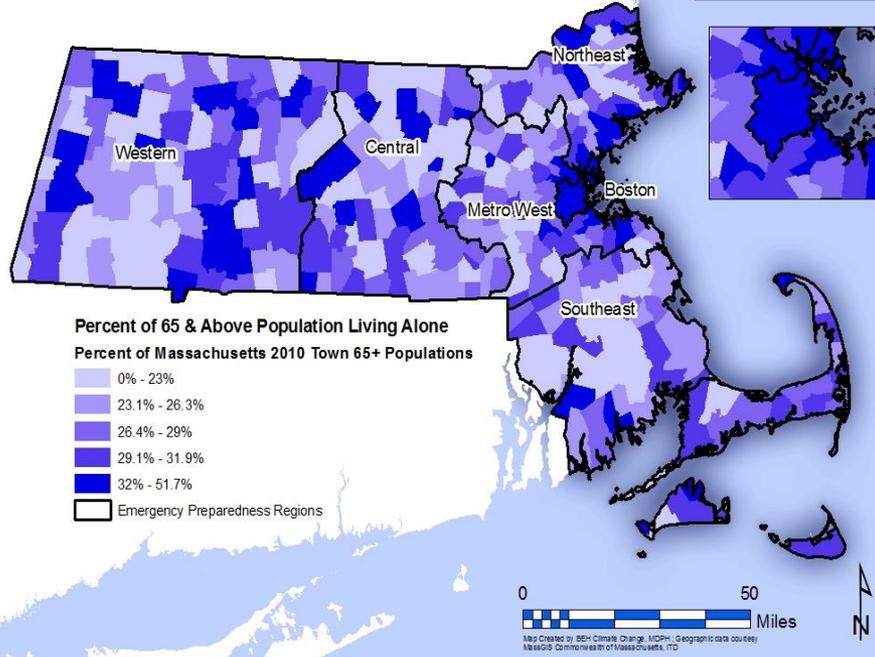
	School Buildings	Municipal Buildings	Total (lbs)
PM2.5	9.4	5.7	15.2
PM10	10.6	6.4	17.0
CO	22.2	13.5	35.6
NOX	106.4	64.6	171.0

ENERGY EFFICIENCY

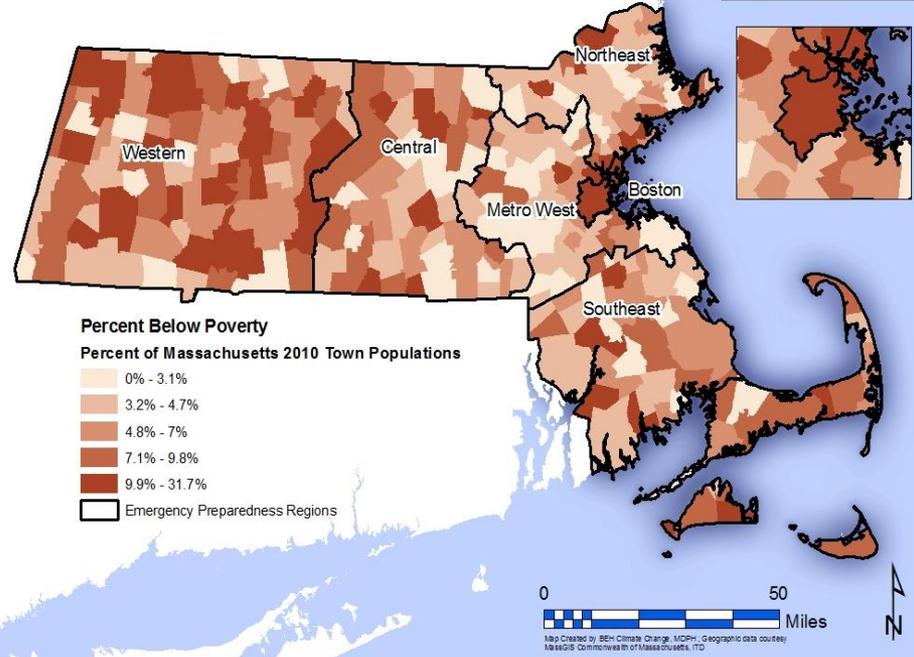
	Impact		Health Outcome		Limitations / Uncertainties
	Impact	Magnitude	Severity	Strength of Causal Evidence	
Change in local and regional exposure to outdoor air pollution					
Respiratory illness and symptoms	-	Major	High	◆◆◆	Assumptions: Reduction in local sources of emissions from municipal buildings (e.g., fuel switching, more efficient HVAC) Reductions in indoor air pollutants from improved indoor air quality (e.g., mold, radon)
Respiratory and cardiovascular diseases	-	Major	High	◆◆◆	
Change in premature mortality	-	Major	High	◆◆◆	
Change in lung cancer	-	Major	High	◆◆◆	
Restricted activity days and work loss days	-	Major	High	◆◆◆	
Change in mental health	-	Major	High	◆◆◆	
Change in community health measures	-	Major	High	◆◆◆	

Example of Data of Vulnerable Populations

Percent of 65+ Population Living Alone
 Massachusetts 2010 Towns & Emergency Preparedness Regions
 Based on 2010 US Decennial Census



Percent of Population Living at or below Poverty
 Massachusetts 2010 Towns & Emergency Preparedness Regions
 Based on 2010 Census Five-Year Estimates



Next steps: Recommendations and Reporting

☞ Recommendations:

- Preliminary:
 - Publicize the connection between public health and energy efficiency strategies in climate action planning and implementation
 - Expand assistance to targeted municipalities to plan for cooling centers
 - Support municipal and regional climate action and planning
- Work with stakeholders to finalize recommendations

☞ Reporting:

- The report will be distributed to town officials and stakeholders in Springfield and Williamsburg.
- The results will also be reported on the PVPC and the MDPH websites.

☞ Monitoring:

- The effect of this HIA on decision-making in Springfield and Williamsburg will be monitored.
- The effect of the decisions taken in each community on local and regional health will be studied to test the accuracy of the predictions in the HIA.