



# INCIDENT CANCER RISK: PFAS-EXPOSED COMMUNITY

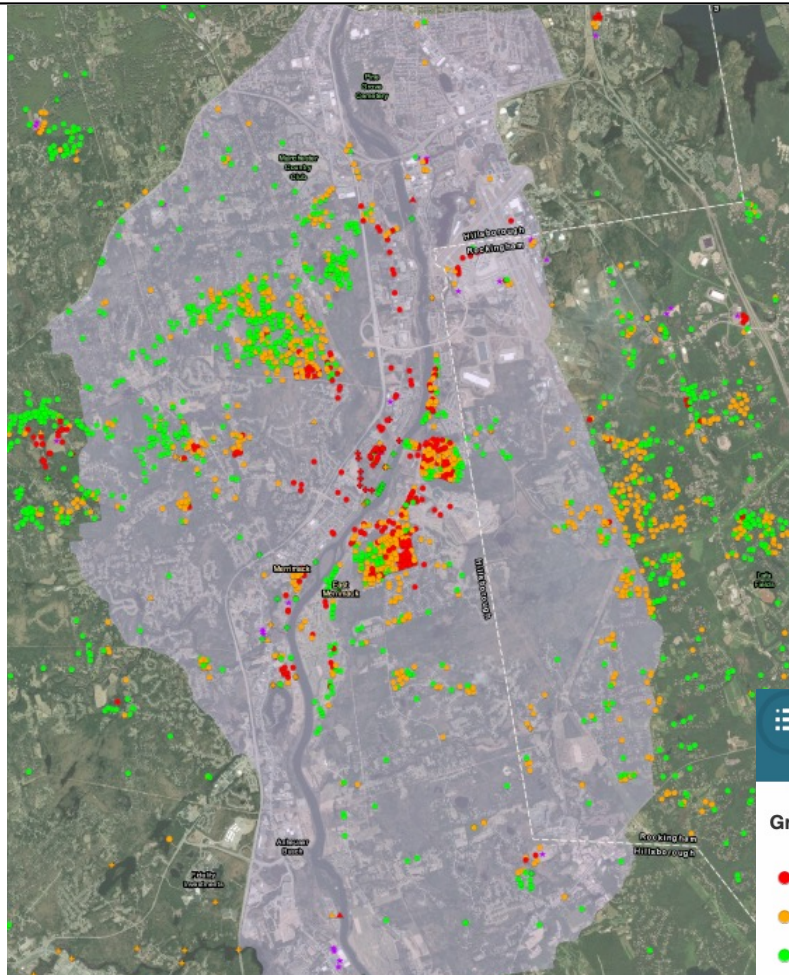
***Mindi F. Messmer***; Ben Locwin,; Nora Traviss,  
PhD; Jeffrey Salloway, PhD; Nawar Shara, PhD.

***Teflon Town: ChemFab's toxic legacy***



File photo/Bennington Banner

Saint Gobain Performance Plastics  
moved from Bennington, VT to  
Merrimack, NH in 2002.



 Legend

**Groundwater Samples**

- PFOA+PFOS >70 ppt
- PFAS > AGQS / MCL
- PFAS ≤ AGQS / MCL

ENVIRONMENT & SCIENCE

## NH Expands Area for PFOA Private Well Testing

By NHDES news release April 13, 2016

## PFOA crisis ongoing

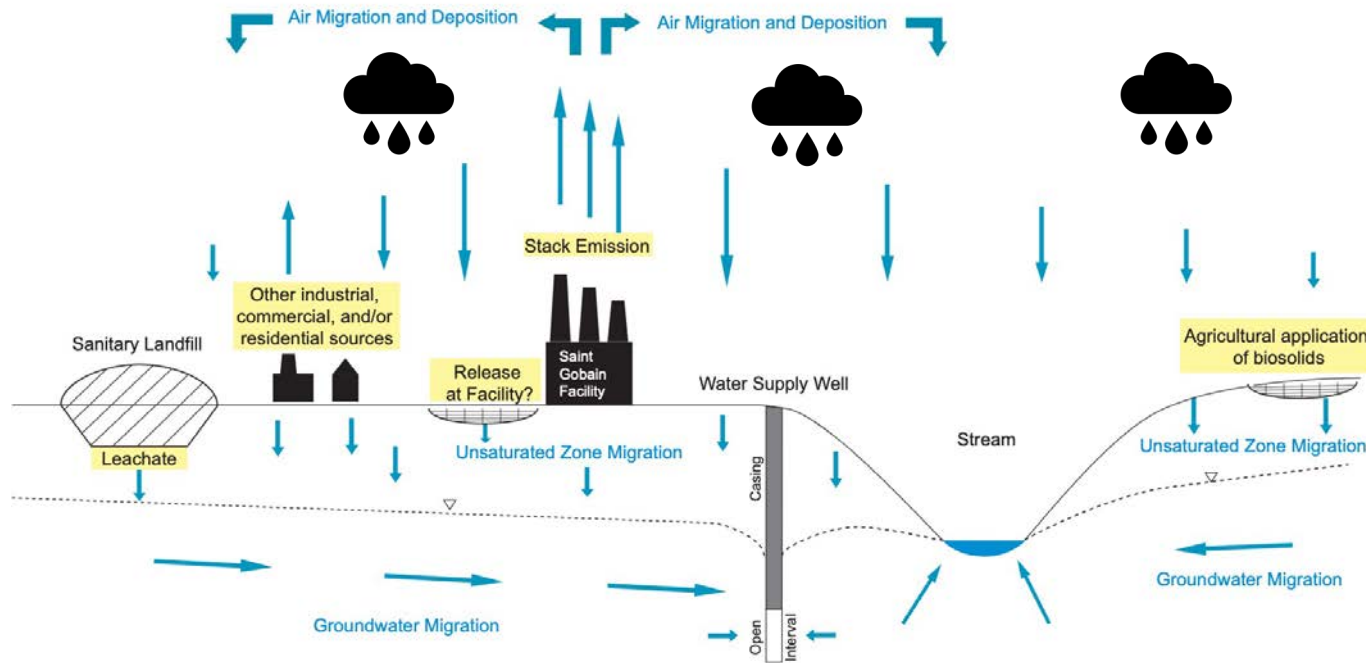
Merrimack residents await resolution of Saint-Gobain water contamination

By Ken Liebeskind - Correspondent | Mar 18, 2018

## 26 wells in Merrimack, Litchfield found to contain PFOA

State officials have released updated results of well water tests in Merrimack and Litchfield.

## Conceptual Model



### LEGEND

- Water Table
- PFOA Migration
- Potential PFOA Release Method

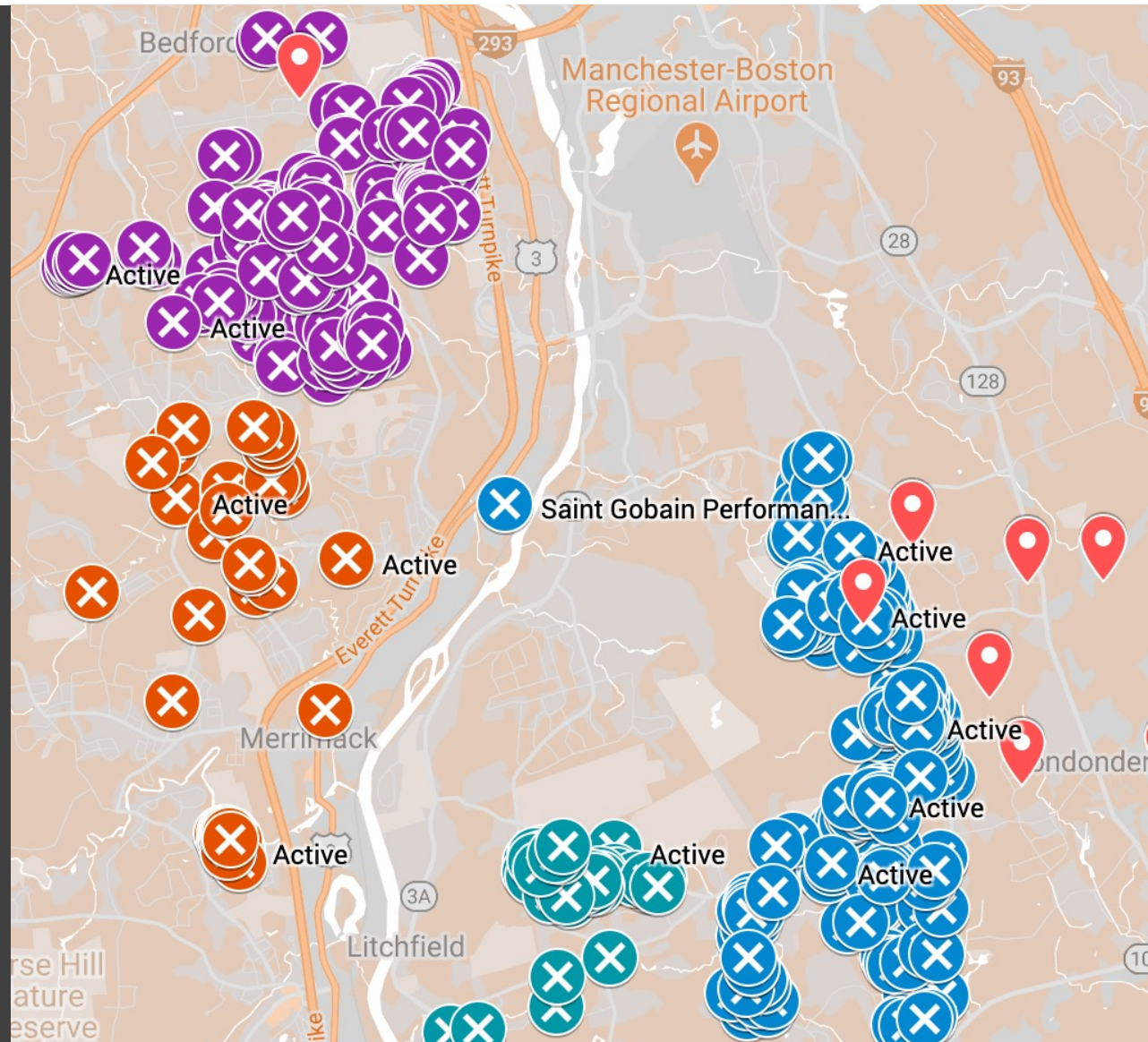


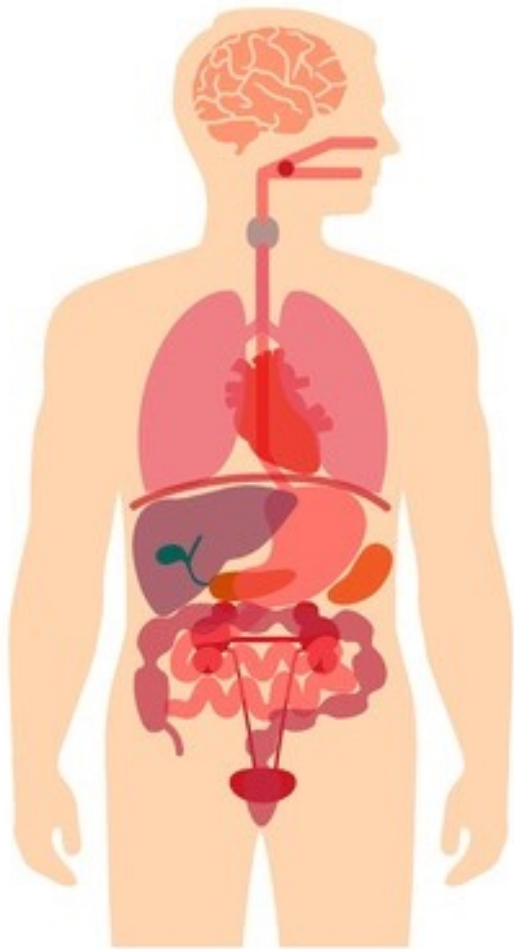
AIR EMISSIONS  
CONTAMINATE  
GROUNDWATER/  
DRINKING WATER  
FOR DECADES IN  
SOUTHERN NH



BOTTLED WATER  
PROVIDED TO 577  
PRIVATE WELL OWNERS

48 IN MERRIMACK  
278 IN LONDONDERRY  
44 IN LITCHFIELD  
207 IN BEDFORD





## What Are the Health Risks of PFAS?

- **Humans**

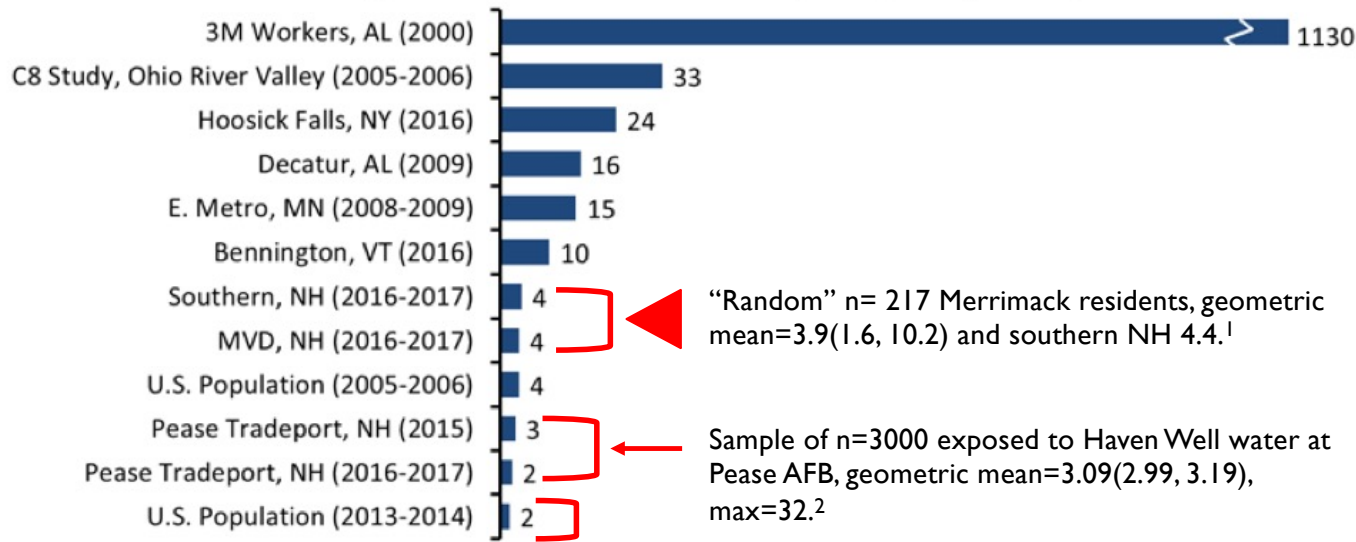
- Elevated cholesterol
- Thyroid disease
- Cancer (prostate, testicular, kidney, breast)
- Pregnancy-induced hypertension
- Ulcerative colitis
- Decreased fertility
- Immune system/Reduced vaccine efficacy
- Hormone system disruption
- Liver enzyme disruption
- Decreased birth weight

Probable link –  
C8 Science Panel

Grandjean,  
et al.

ATSR “may  
cause”

### Average PFOA Levels in Blood (Micrograms per Liter)



PFOA SERUM LEVELS IN MERRIMACK ARE TWICE THE NATIONAL AVERAGE

1- Source: NHDHHS, 2017. Merrimack Village District Community Exposure Assessment Summary Report.  
 2- Source: NHDHHS, 2016. Pease PFC Blood Testing Program: April 2015-October 2015.



# Cancer Incidence Report Merrimack, NH

Prepared by:

New Hampshire Department of Health and Human Services,  
Division of Public Health Services

January 2018

Report concluded “none of the cancers in Merrimack, NH [when compared with state incidence rates] were significantly higher than expected.”

## Results

### All Cancer Types - Overview of Findings

We compared the observed to the expected numbers of cancer cases for 24 types of cancer for males and 26 types of cancer for females. For cancers affecting both sexes, the observed and expected number of cancer cases were compared for both males and females combined. Table 2 summarizes the results of the cancer analysis, showing that none of the cancers in Merrimack, NH occurred in significantly higher numbers than would be expected.



COMPARISON OF  
MERRIMACK  
CANCER RATES TO  
STATE RATES



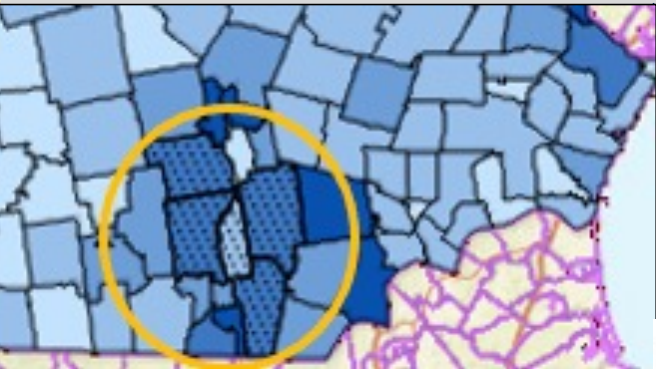
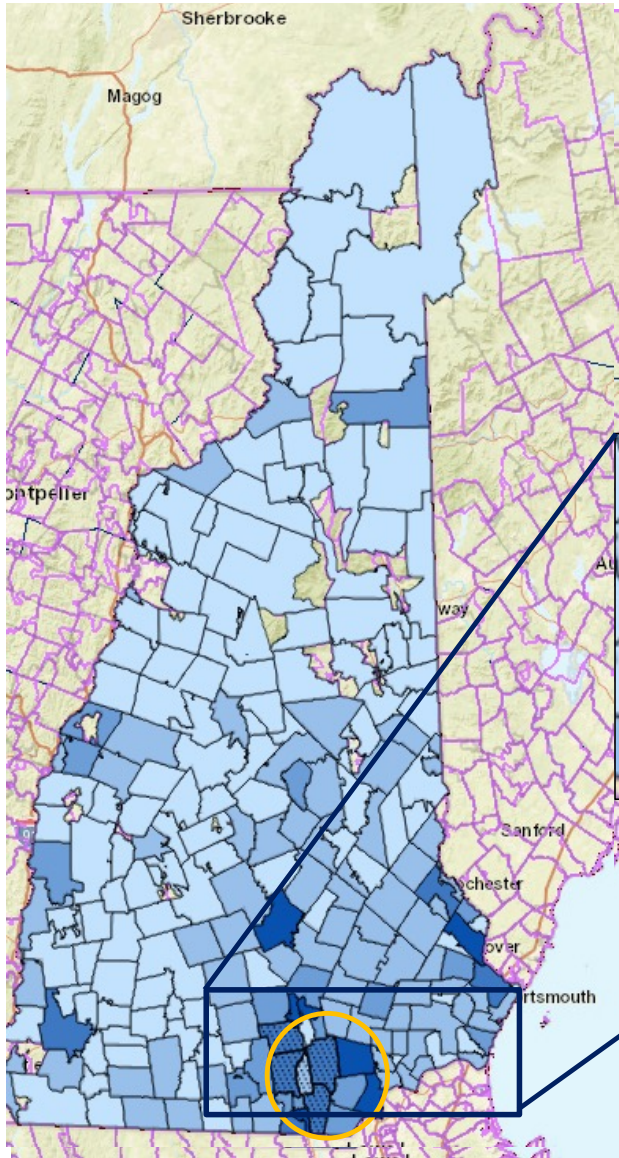


Research | [Open Access](#) | [Published: 30 August 2019](#)

## Making the invisible visible: results of a community-led health survey following PFAS contamination of drinking water in Merrimack, New Hampshire

Found elevated levels of **autoimmune, kidney, cardiovascular, respiratory, liver and reproductive disorders** in Merrimack citizens.

# COMMUNITY-LED HEALTH STUDY

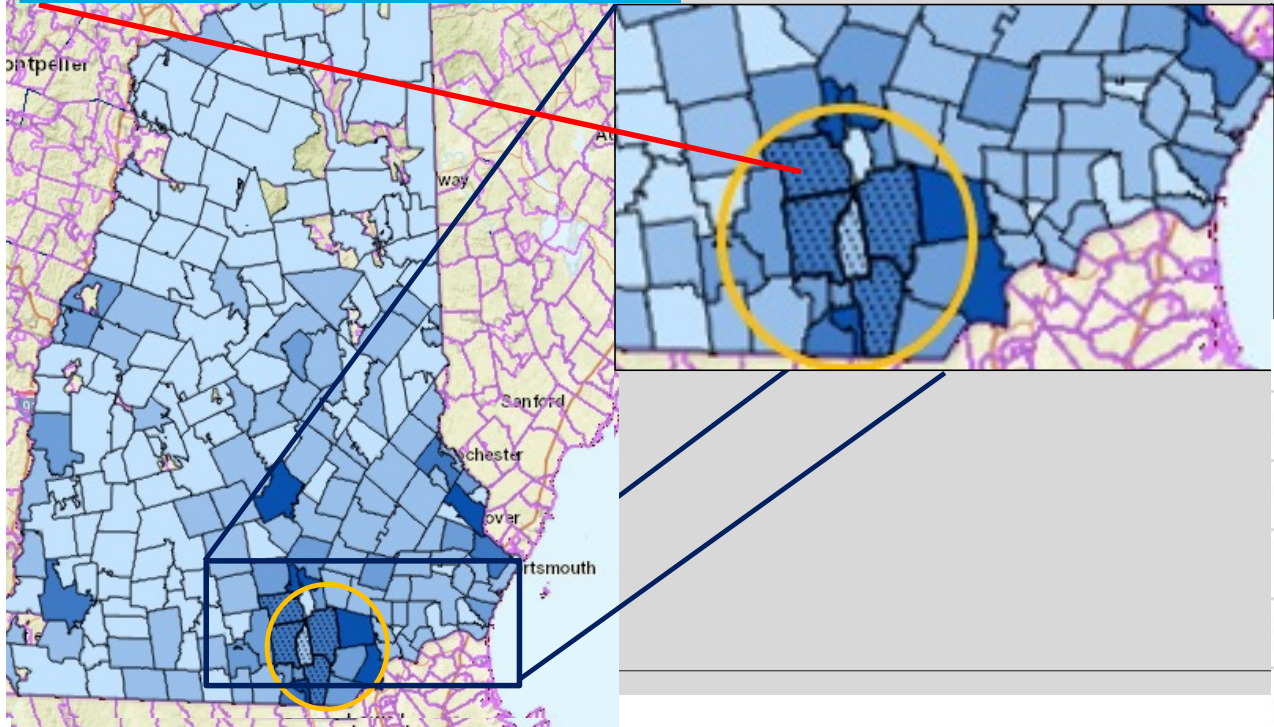


**NH 2010 Population (2010 population)**

0 - 3365	
> 3365 - 8936	
> 8936 - 17651	
> 17651 - 26694	
> 26694 - 42695	

03110, Bedford

Pop: Total (#) 2015-2019:	22,535
Pop: Low-Income (#) 2015-2019:	1,552
HCP: Total Patients (#) 2019:	126
HCP: Penetration of Total Population (%):	0.56 %
HCP: Penetration of Low-Income (%):	8.12 %

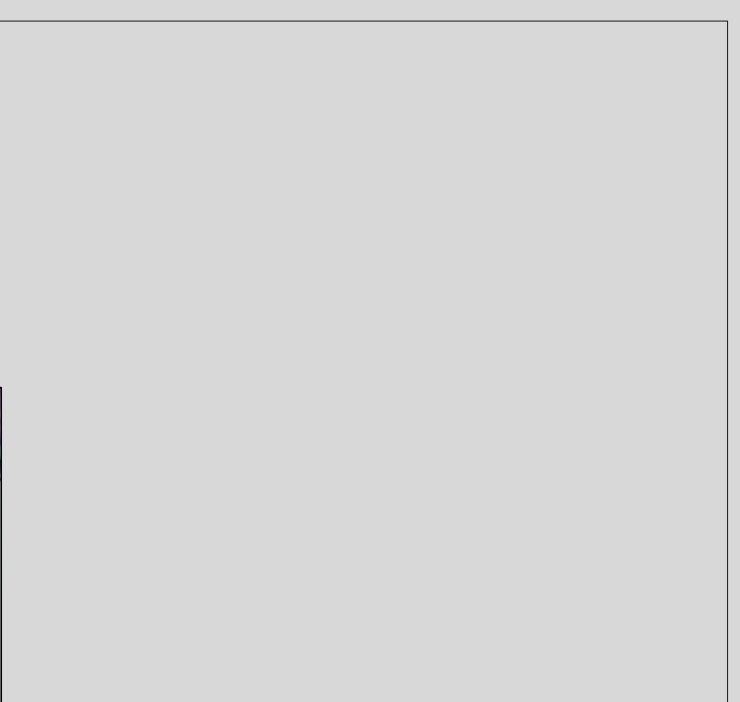
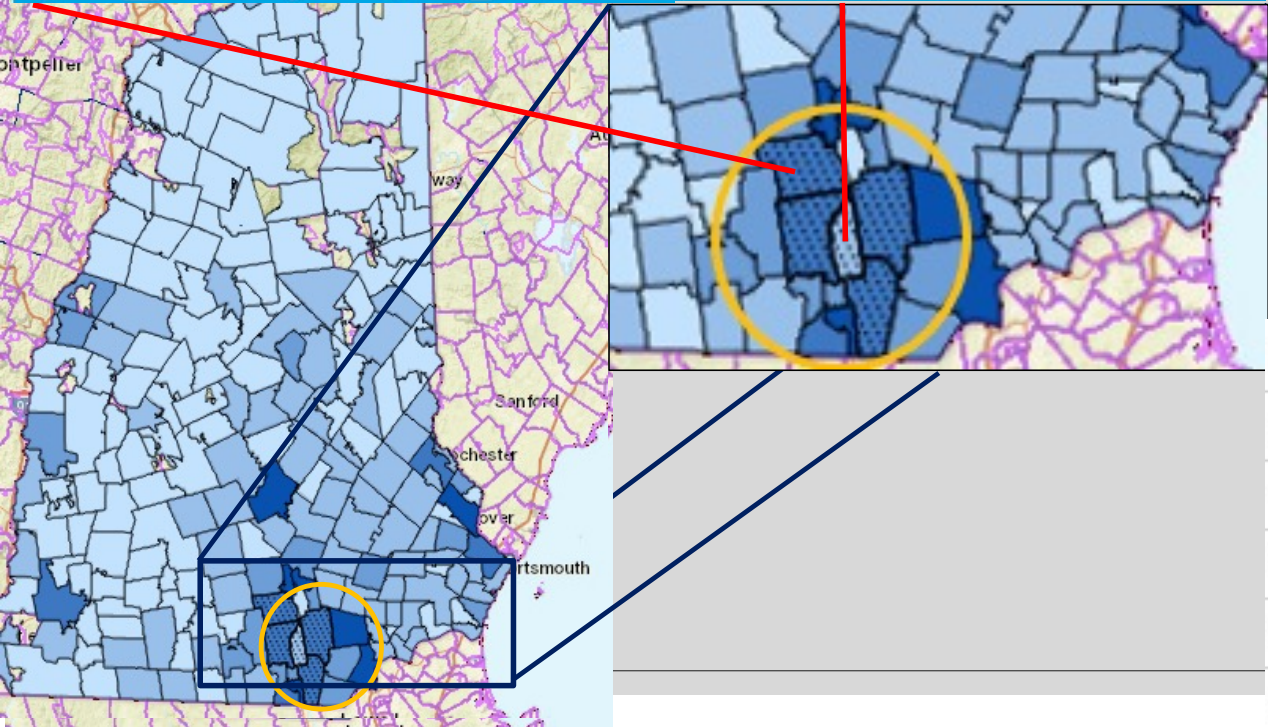


NH 2010 Population (2010 population)






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03110, Bedford		03052, Litchfield	
Pop: Total (#) 2015-2019:	22,535	Pop: Total (#) 2015-2019:	8,514
Pop: Low-Income (#) 2015-2019:	1,552	Pop: Low-Income (#) 2015-2019:	246
HCP: Total Patients (#) 2019:	126	HCP: Total Patients (#) 2019:	100
HCP: Penetration of Total Population (%):	0.56 %	HCP: Penetration of Total Population (%):	1.17 %
HCP: Penetration of Low-Income (%):	8.12 %	HCP: Penetration of Low-Income (%):	40.65 %

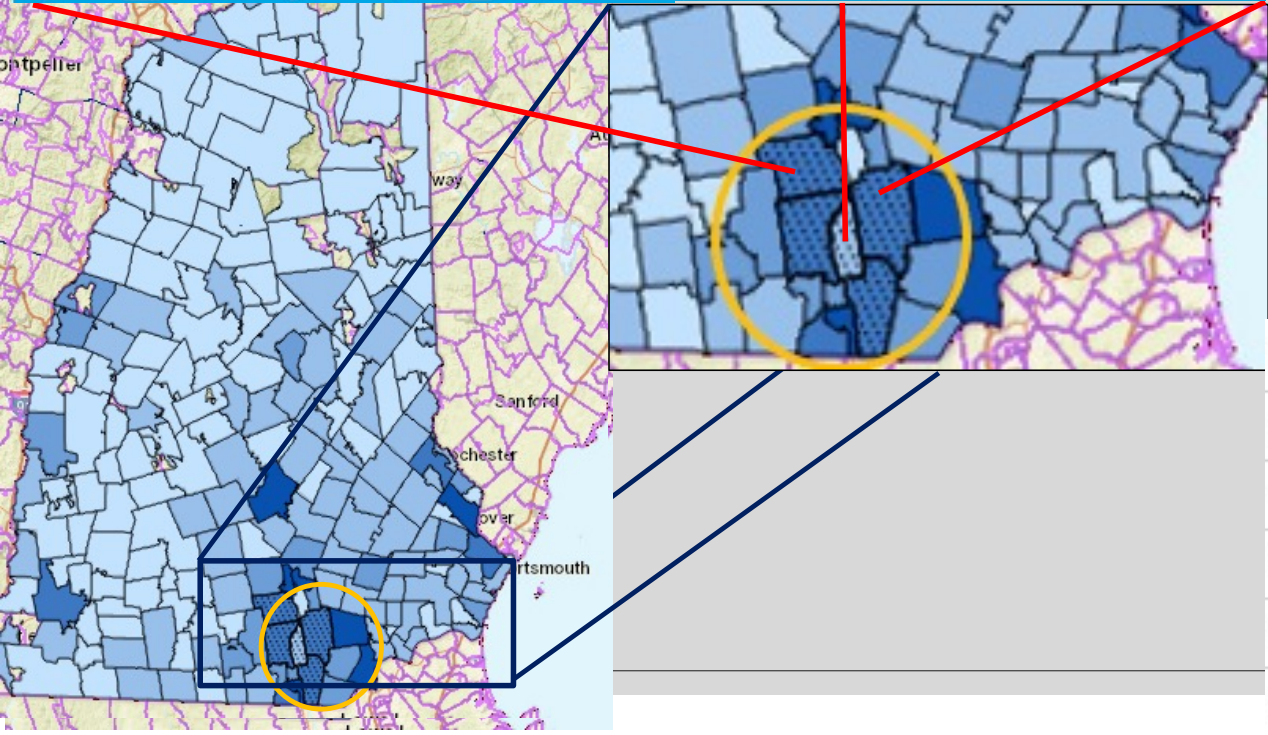


**NH 2010 Population (2010 population)**

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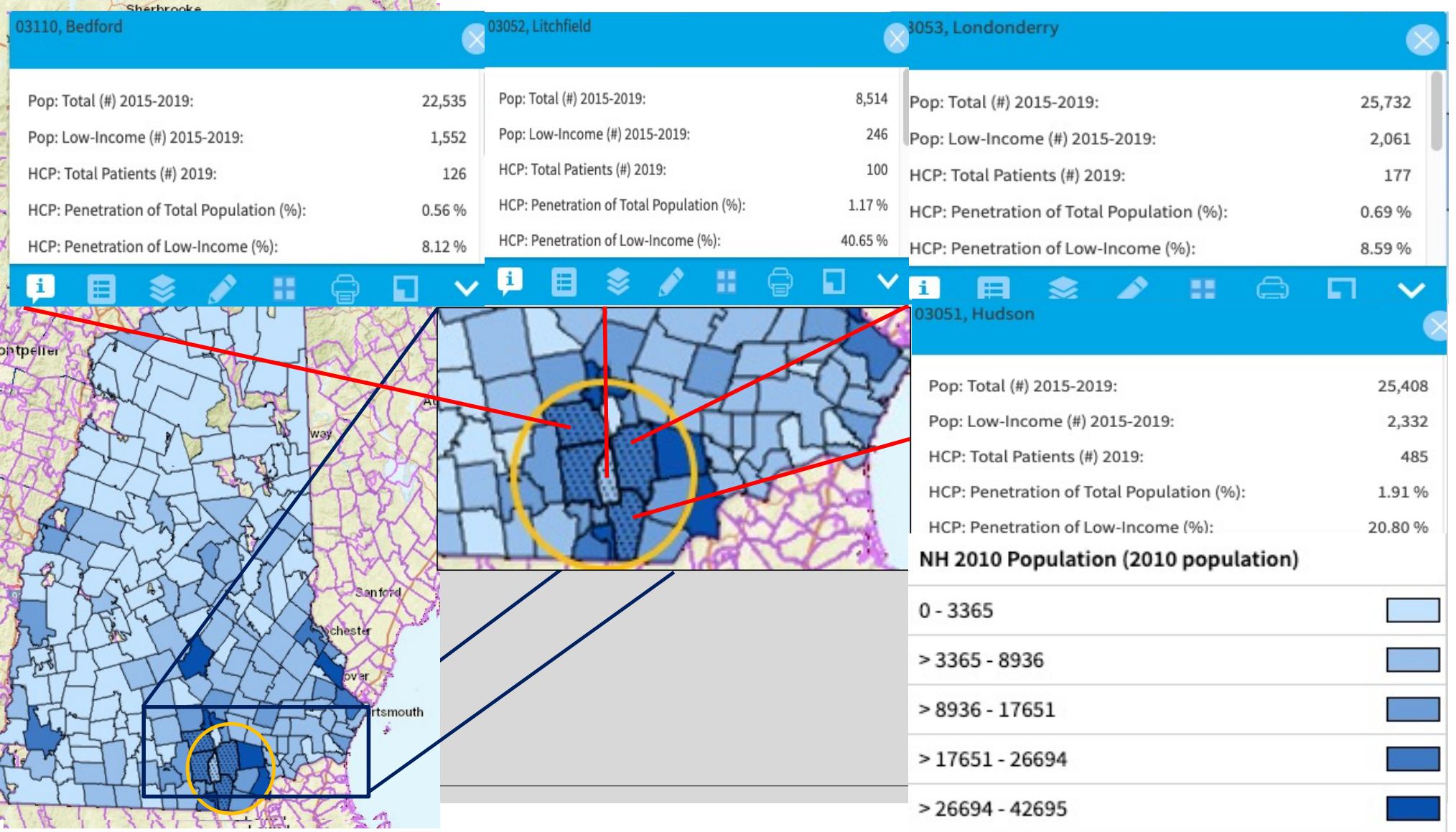


03110, Bedford		03052, Litchfield		03053, Londonderry	
Pop: Total (#) 2015-2019:	22,535	Pop: Total (#) 2015-2019:	8,514	Pop: Total (#) 2015-2019:	25,732
Pop: Low-Income (#) 2015-2019:	1,552	Pop: Low-Income (#) 2015-2019:	246	Pop: Low-Income (#) 2015-2019:	2,061
HCP: Total Patients (#) 2019:	126	HCP: Total Patients (#) 2019:	100	HCP: Total Patients (#) 2019:	177
HCP: Penetration of Total Population (%):	0.56 %	HCP: Penetration of Total Population (%):	1.17 %	HCP: Penetration of Total Population (%):	0.69 %
HCP: Penetration of Low-Income (%):	8.12 %	HCP: Penetration of Low-Income (%):	40.65 %	HCP: Penetration of Low-Income (%):	8.59 %

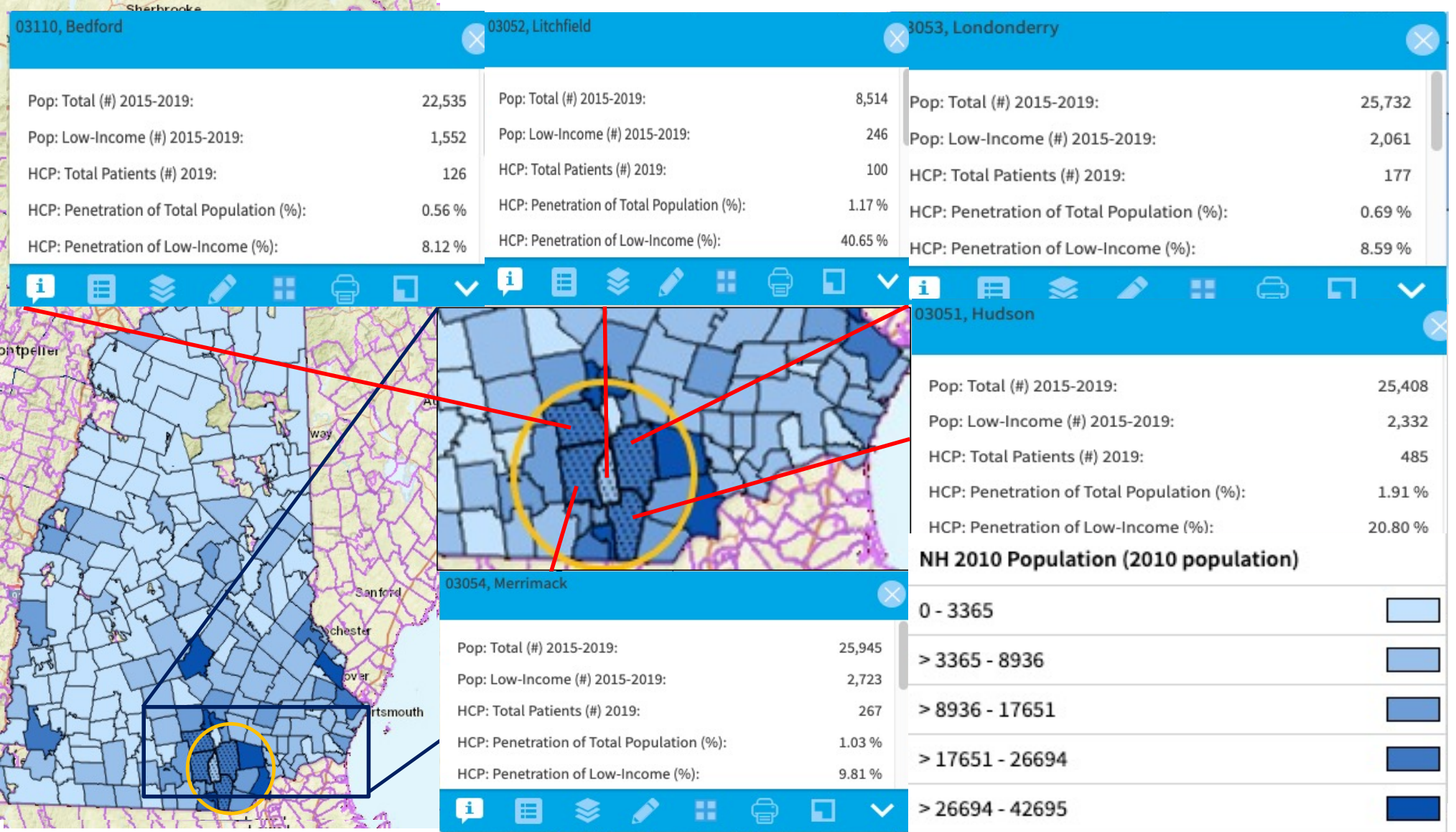


**NH 2010 Population (2010 population)**

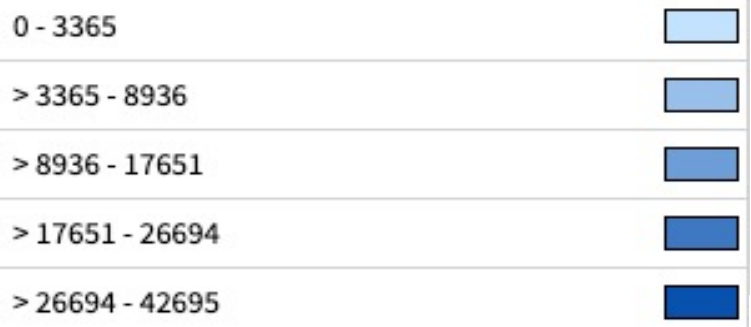
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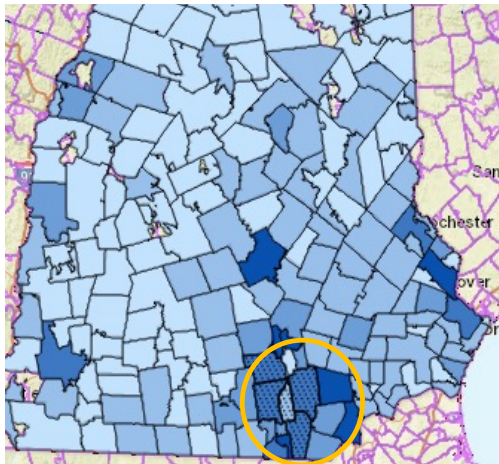
**NH 2010 Population (2010 population)**



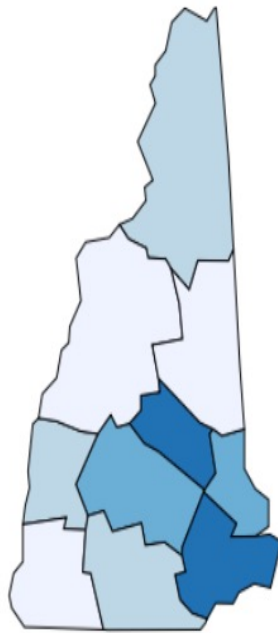
Rate of New Cancers in New Hampshire

All Types of Cancer, All Ages, All Races/Ethnicities, Male and Female, 2013-2017

Population by ZCTA



Cancer incidence by county 2013-2017



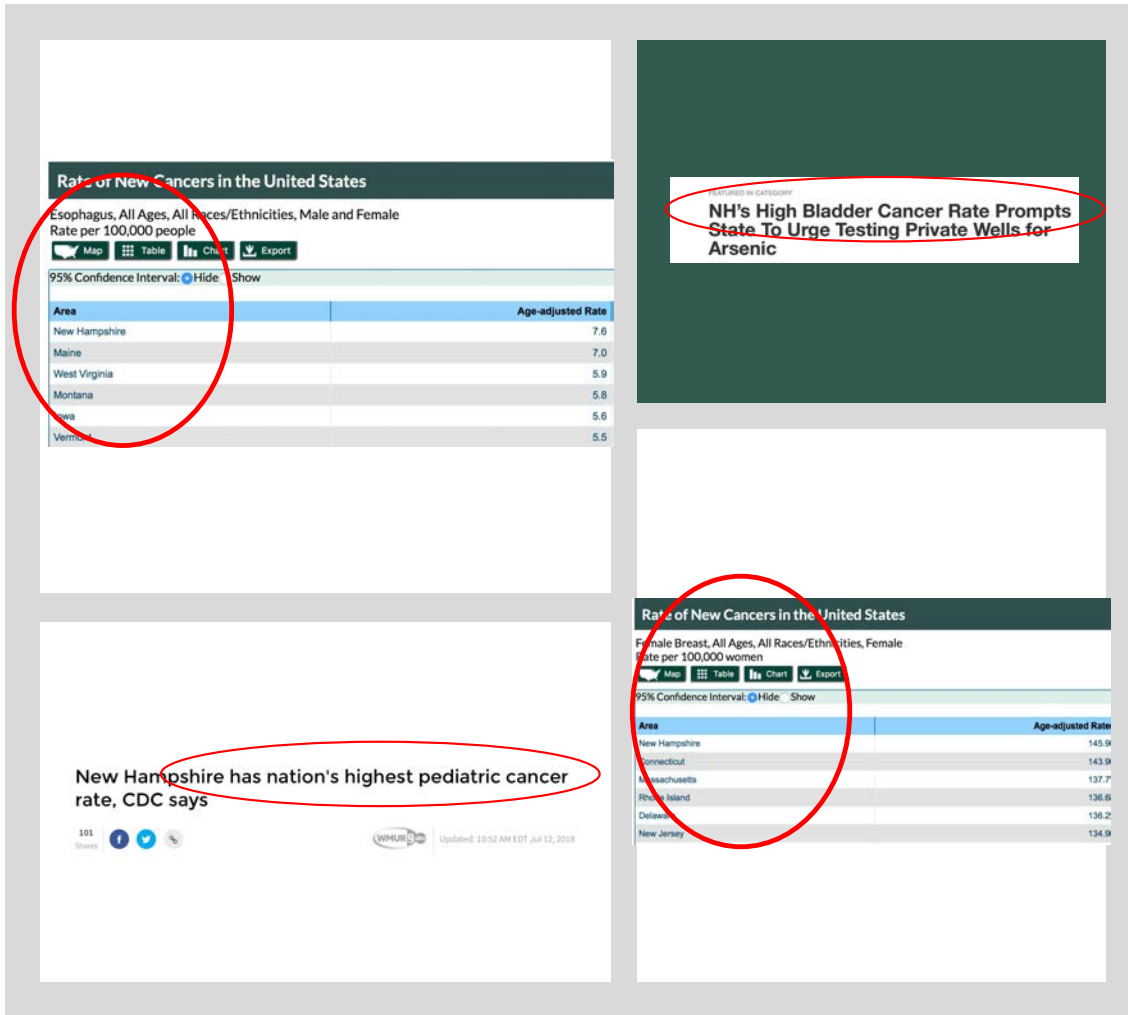
Rate per 100,000 people

Data source – U.S. Cancer Statistics Working Group. U.S. Cancer Statistics Data Visualizations Tool, based on November 2019 submission data (1999-2017); U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; <https://www.cdc.gov/cancer/dataviz>, June 2020.



CONCERNS  
ABOUT STATE  
COMPARATOR –  
CANCER RATES IN  
DENSE  
POPULATION  
AREAS

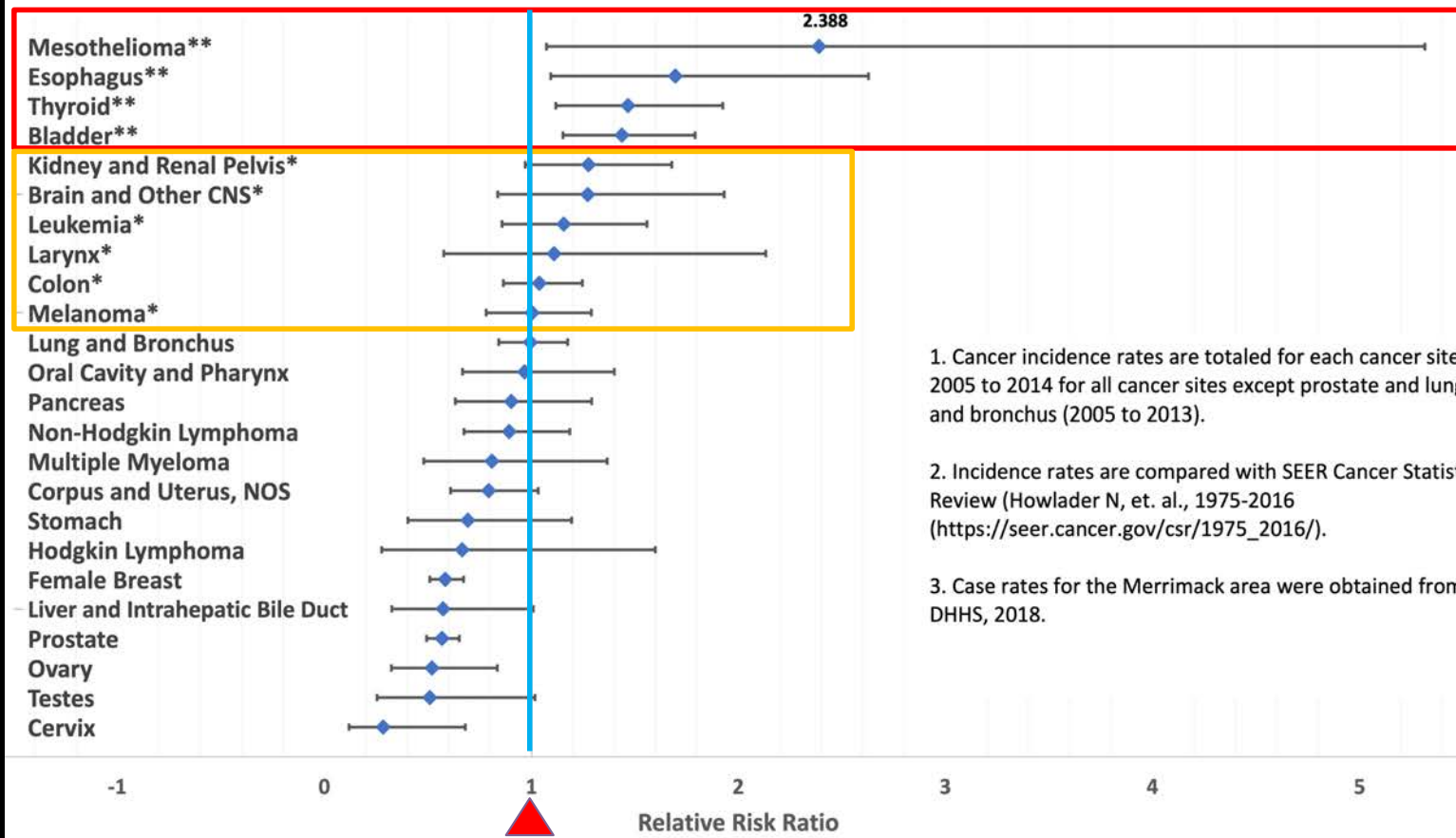




**NH has the highest rates of some cancers in the nation.**

# RISK RATIOS: MERRIMACK V. NCI SEER

Relative Risk Ratio For Merrimack, NH v. SEER (2005 to 2014)



1. Cancer incidence rates are totaled for each cancer site for 2005 to 2014 for all cancer sites except prostate and lung and bronchus (2005 to 2013).
2. Incidence rates are compared with SEER Cancer Statistics Review (Howlander N, et. al., 1975-2016 ([https://seer.cancer.gov/csr/1975\\_2016/](https://seer.cancer.gov/csr/1975_2016/))).
3. Case rates for the Merrimack area were obtained from DHHS, 2018.

<b>Merrimack v. Maine Town Comparator Demographics</b>	<b>Merrimack, NH</b>	<b>South Portland, ME</b>	<b>Auburn, ME</b>	<b>Sanford, ME</b>
Population, Census, April 1, 2010	25,494	25,002	23,055	20,798
Population per square mile, 2010	783.7	2,086.10	388.6	NA
<b>Age</b>				
Persons under 18 years, percent	21.60%	17.90%	21.30%	22.40%
Persons 65 years and over, percent	15.10%	16.70%	18.30%	16.90%
<b>Gender</b>				
Female persons, percent	49.40%	52.10%	52.00%	53.00%
<b>Race, Ethnicity</b>				
White alone, percent	92.30%	89.80%	91.00%	93.20%
Black or African American alone, percent	1.00%	4.30%	1.30%	1.00%
Asian alone, percent	2.00%	1.60%	1.20%	2.50%
Hispanic or Latino, percent	3.70%	2.80%	2.00%	1.80%
<b>Economic/Health Factors</b>				
Persons without health insurance, under age 65 years, percent	4.00%	7.30%	8.80%	8.40%
Median household income (in 2019 dollars), 2015-2019	\$107,232	\$69,290	\$49,719	\$52,513
Persons in poverty, percent	3.90%	8.80%	11.30%	13.90%
Owner-occupied housing unit rate, 2015-2019	86.80%	63.40%	55.90%	59.20%
Median value of owner-occupied housing units, 2015-2019	\$283,200	\$257,200	\$165,200	\$183,800
Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019	91.20%	86.50%	82.50%	83.40%
<b>Education</b>				
High school graduate or higher, percent of persons age 25 years+, 2015-2019	96.50%	96.00%	90.90%	91.80%
Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019	46.60%	45.70%	28.50%	19.40%

<b>Merrimack v. Vermont Town Comparator Demographics</b>	<b>Merrimack, NH</b>	<b>Colchester, VT</b>	<b>Bennington, VT</b>
Population, Census, April 1, 2010	25,494	17,067	15,764
Population per square mile, 2010	783.7	469.9	373.1
<b>Age</b>			
Persons under 18 years, percent	21.60%	17.40%	16.30%
Persons 65 years and over, percent	15.10%	13.00%	21.50%
<b>Gender</b>			
Female persons, percent	49.40%	51.00%	52.90%
<b>Race, Ethnicity</b>			
White alone, percent	92.30%	93.10%	93.80%
Black or African American alone, percent	1.00%	2.90%	1.20%
Asian alone, percent	2.00%	1.90%	0.90%
Hispanic or Latino, percent	3.70%	2.80%	3.20%
<b>Economic/Health Factors</b>			
Persons without health insurance, under age 65 years, percent	4.00%	2.80%	6.60%
Median household income (in 2019 dollars), 2015-2019	\$107,232	\$71,090	\$50,892
Persons in poverty, percent	3.90%	10.90%	15.00%
Owner-occupied housing unit rate, 2015-2019	86.80%	68.70%	61.50%
Median value of owner-occupied housing units, 2015-2019	\$283,200	\$265,000	\$164,600
Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019	91.20%	80.70%	87.00%
<b>Education</b>			
High school graduate or higher, percent of persons age 25 years+, 2015-2019	96.50%	94.50%	90.30%
Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019	46.60%	43.10%	31.80%



Water District	PFAS in Drinking Water
Merrimack, NH <sup>1*</sup>	140 parts per trillion (ppt)
<b>Comparator Towns with no known PFOA</b>	
Portland, ME Water District <sup>2</sup>	PFOA 2 ppt
Auburn, ME Water District <sup>2</sup>	PFOA Not detected (ND)
Sanford, ME Water District <sup>2</sup>	PFOA ND
Colchester, VT <sup>4</sup>	PFAS ND
<b>Comparator Town with known PFOA</b>	
Bennington VT <sup>3</sup>	40 to 2880 ppt PFOA

\* Data listed for Merrimack Valley Water District (MVD) well MW-4 which along with MW-5 were shut down in 2016 due to PFOA contamination..

1- Merrimack data from: <https://www4.des.state.nh.us/IISProxy/IISProxy.dll?ContentId=4649008>.

2- Maine data retrieved from Maine DEP GIS:

<https://maine.maps.arcgis.com/apps/webappviewer/index.html?id=815b4093464c405daf7a17e43a1d9da7>

3- Bennington VT data: <https://www.healthvermont.gov/response/environmental/pfoa-drinking-water-2016>

4- Colchester VT data: <https://www.healthvermont.gov/response/environmental/pfoa-drinking-water-2016>



## PFAS IN WATER SYSTEMS

<b>Merrimack v. Vermont Town Comparator Demographics</b>	<b>Merrimack, NH</b>	<b>Colchester, VT</b>	<b>EXPOSED PFAS Bennington, VT</b>
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White alone, percent	92.30%	93.10%	93.80%
Black or African American alone, percent	1.00%	2.90%	1.20%
Asian alone, percent	2.00%	1.90%	0.90%
Hispanic or Latino, percent	3.70%	2.80%	3.20%
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Merrimack v. SEER	Merrimack v. Sanford	Merrimack v. Auburn	Merrimack v. South Portland
Mesothelioma **	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>
Esophagus **	<b>Thyroid**</b>	Kidney and Renal Pelvis <sup>+</sup>	<b>Thyroid**</b>
Thyroid **	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Prostate**</b>
Bladder **	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>
Kidney and Renal Pelvis <sup>+</sup>	<b>Colon**</b>	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>
Brain and other CNS <sup>+</sup>	<b>Female Breast**</b>	Corpus and Uterus <sup>+</sup>	
Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>	
Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>	
Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>	
Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>	
	Non-Hodgkin Lymphoma <sup>+</sup>		
	Corpus and Uterus <sup>+</sup>		
	Kidney and Renal Pelvis <sup>+</sup>		


Merrimack v. Colchester	Merrimack v. Bennington
<b>Colon**</b>	None
<b>Prostate**</b>	
Bladder <sup>+</sup>	
Lung and Bronchus <sup>+</sup>	
Female Breast <sup>+</sup>	
No VT Data for Kidney, Thyroid and Esophagus	

**Legend**

1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom).
2. \*\* Statistically significant increased relative risk.
3. +Elevated relative risk.

<b>R E L A T I V E  R I S K</b> 	Merrimack v. SEER	Merrimack v. Sanford	Merrimack v. Auburn	Merrimack v. South Portland	Merrimack v Colchester	Merrimack v. Bennington
	Mesothelioma **	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	Colon**	None
	Esophagus **	<b>Thyroid**</b>	Kidney and Renal Pelvis <sup>+</sup>	<b>Thyroid**</b>	<b>Prostate**</b>	
	<b>Thyroid **</b>	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Prostate**</b>	Bladder <sup>+</sup>	
	<b>Bladder **</b>	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	<b>Colon**</b>	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Female Breast**	<b>Female Breast**</b>	Corpus and Uterus <sup>+</sup>		<b>No VT Data for Mesothelioma, Kidney, Thyroid and Esophagus</b>	
	Esophagus <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>		<b>Legend</b> 1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom). 2. ** Statistically significant increased relative risk. 3. +Elevated relative risk.	
	Brain and other CNS <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>			
	Leukemia <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>			
	Larynx <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>			
	Colon <sup>+</sup>	Non-Hodgkin Lymphoma <sup>+</sup>				
	Melanoma <sup>+</sup>	Corpus and Uterus <sup>+</sup>				
		Kidney and Renal Pelvis <sup>+</sup>				

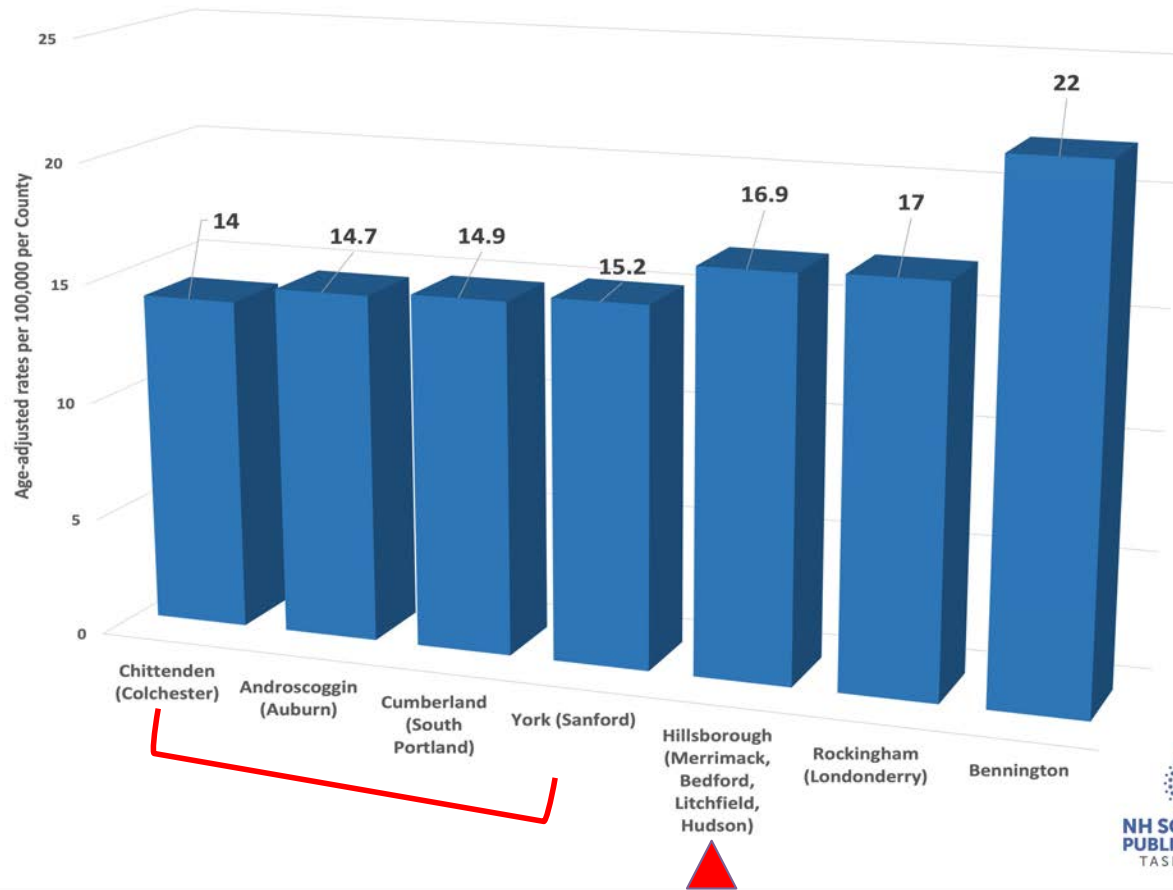


<b>R E L A T I V E  R I S K</b> 	<b>Merrimack v. SEER</b>	<b>Merrimack v. Sanford</b>	<b>Merrimack v. Auburn</b>	<b>Merrimack v. South Portland</b>	<b>Merrimack v Colchester</b>	<b>Merrimack v. Bennington</b>
	<b>Mesothelioma **</b>	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Colon**</b>	None
	<b>Esophagus **</b>	<b>Thyroid**</b>	Kidney and Renal Pelvis <sup>+</sup>	<b>Thyroid**</b>	<b>Prostate**</b>	
	<b>Thyroid **</b>	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Prostate**</b>	Bladder <sup>+</sup>	
	<b>Bladder **</b>	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	<b>Colon**</b>	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
		<b>Female Breast**</b>	Corpus and Uterus <sup>+</sup>		<b>No VT Data</b> for Mesothelioma, Kidney, Thyroid and <b>Esophagus</b>	
		Esophagus <sup>+</sup>	Prostate <sup>+</sup>		<b>Legend</b>	
	Brain and other CNS <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>		1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom).	
	Leukemia <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>		2. ** Statistically significant increased relative risk.	
	Larynx <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>		3. +Elevated relative risk.	
	Colon <sup>+</sup>	Non-Hodgkin Lymphoma <sup>+</sup>				
	Melanoma <sup>+</sup>	Corpus and Uterus <sup>+</sup>				
		Kidney and Renal Pelvis <sup>+</sup>				

<b>R E L A T I V E  R I S K</b> 	<b>Merrimack v. SEER</b>	<b>Merrimack v. Sanford</b>	<b>Merrimack v. Auburn</b>	<b>Merrimack v. South Portland</b>	<b>Merrimack v Colchester</b>	<b>Merrimack v. Bennington</b>
	<b>Mesothelioma **</b>	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Colon**</b>	None
	<b>Esophagus **</b>	<b>Thyroid**</b>	Kidney and Renal Pelvis <sup>+</sup>	<b>Thyroid**</b>	<b>Prostate**</b>	
	<b>Thyroid **</b>	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Prostate**</b>	Bladder <sup>+</sup>	
	<b>Bladder **</b>	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	<b>Kidney and Renal Pelvis<sup>+</sup></b>	<b>Colon**</b>	<b>Thyroid<sup>+</sup></b>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Brain and other CNS <sup>+</sup>	<b>Female Breast**</b>	Corpus and Uterus <sup>+</sup>		No VT Data for Mesothelioma, Kidney, <b>Thyroid</b> and Esophagus	
	Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>			
	Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>		<b>Legend</b> 1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom). 2. ** Statistically significant increased relative risk. 3. +Elevated relative risk.	
	Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>			
	Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>			
		Non-Hodgkin Lymphoma <sup>+</sup>				
		Corpus and Uterus <sup>+</sup>				
		Kidney and Renal Pelvis <sup>+</sup>				

# THYROID CANCER

### Age-Adjusted Thyroid Cancer Rates In Selected Counties New Hampshire, Maine and Vermont



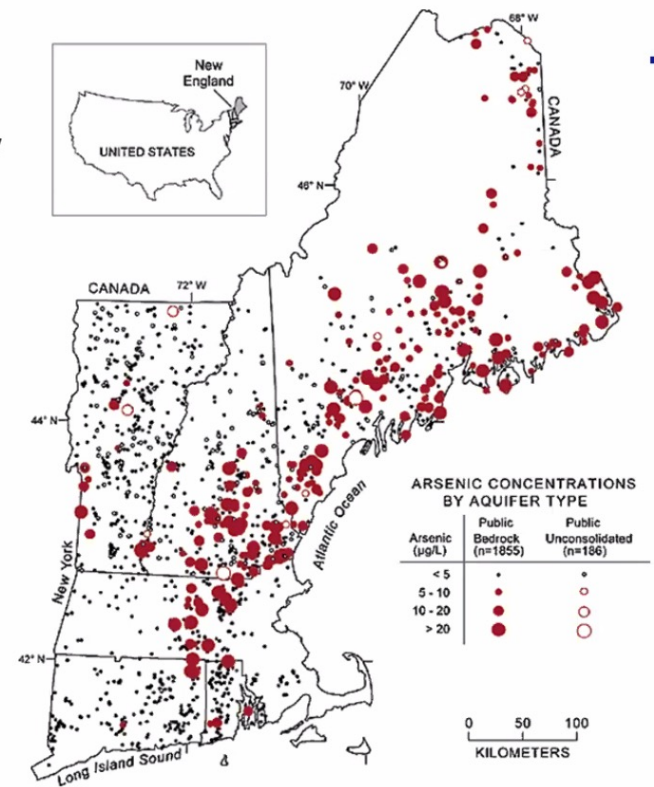
<b>R E L A T I V E  R I S K</b> 	<b>Merrimack v. SEER</b>	<b>Merrimack v. Sanford</b>	<b>Merrimack v. Auburn</b>	<b>Merrimack v. South Portland</b>	<b>Merrimack v Colchester</b>	<b>Merrimack v. Bennington</b>
	<b>Mesothelioma **</b>	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Colon**</b>	None
	<b>Esophagus **</b>	<b>Thyroid**</b>	Kidney and Renal Pelvis <sup>+</sup>	<b>Thyroid**</b>	<b>Prostate**</b>	
	<b>Thyroid **</b>	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	<b>Prostate**</b>	<b>Bladder<sup>+</sup></b>	
	<b>Bladder **</b>	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	<b>Colon**</b>	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Brain and Other CNS <sup>+</sup>	<b>Female Breast**</b>	Corpus and Uterus <sup>+</sup>		No VT Data for Mesothelioma, Kidney, Thyroid and Esophagus	
	Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>		<b>Legend</b> 1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom). 2. ** Statistically significant increased relative risk. 3. +Elevated relative risk.	
	Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>			
	Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>			
	Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>			
		Non-Hodgkin Lymphoma <sup>+</sup>				
		Corpus and Uterus <sup>+</sup>				
		Kidney and Renal Pelvis <sup>+</sup>				

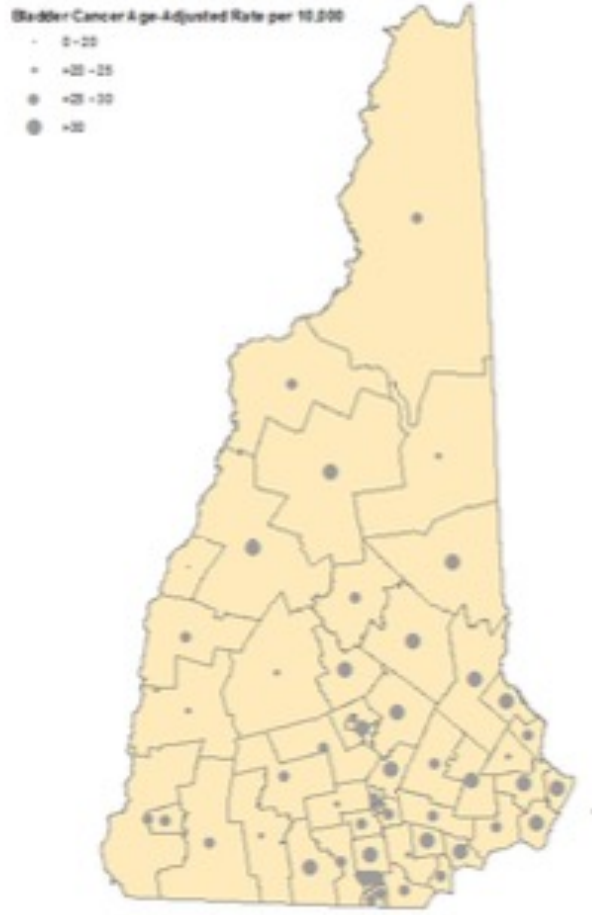


# ARSENIC IN NEW ENGLAND GROUNDWATER

## Arsenic in New England

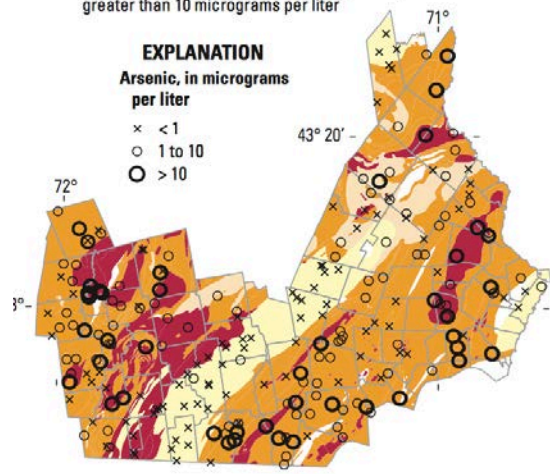
Source: Ayotte et al. 2017.  
Estimating the High-Arsenic Domestic-Well Population in the Conterminous United States.  
*Environmental Science & Technology*





# ARSENIC AND BLADDER CANCER IN NH

**A. Arsenic**  
 Percentage of wells, by grouped geologic units, with arsenic greater than 10 micrograms per liter



R E L A T I V E  R I S K  ↓	Merrimack v. SEER	Merrimack v. Sanford	Merrimack v. Auburn	Merrimack v. South Portland	Merrimack v Colchester	Merrimack v. Bennington
	Mesothelioma **	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	Colon**	None
	Esophagus **	Thyroid**	Kidney and Renal Pelvis <sup>+</sup>	Thyroid**	Prostate**	
	Thyroid **	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	Prostate**	Bladder <sup>+</sup>	
	Bladder **	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	Colon**	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Brain and other CNS <sup>+</sup>	Female Breast**	Corpus and Uterus <sup>+</sup>		<b>No VT Data</b> for Mesothelioma, <b>Kidney</b> , Thyroid and Esophagus	
	Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>		<b>Legend</b>	
	Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>		1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom).	
	Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>		2. ** Statistically significant increased relative risk.	
	Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>		3. +Elevated relative risk.	
		Non-Hodgkin Lymphoma <sup>+</sup>				
		Corpus and Uterus <sup>+</sup>				
	Kidney and Renal Pelvis <sup>+</sup>					

RELATIVE RISK ↓	Merrimack v. SEER	Merrimack v. Sanford	Merrimack v. Auburn	Merrimack v. South Portland	Merrimack v Colchester	Merrimack v. Bennington
	Mesothelioma **	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	Colon**	None
	Esophagus **	Thyroid**	Kidney and Renal Pelvis <sup>+</sup>	Thyroid**	Prostate**	
	Thyroid **	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	Prostate**	Bladder <sup>+</sup>	
	Bladder **	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	Colon**	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Brain and other CNS <sup>+</sup>	Female Breast**	Corpus and Uterus <sup>+</sup>		No VT Data for Mesothelioma, Kidney, Thyroid and Esophagus	
	Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>		Legend	
	Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>		1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom).	
	Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>		2. ** Statistically significant increased relative risk.	
	Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>		3. +Elevated relative risk.	
		Non-Hodgkin Lymphoma <sup>+</sup>				
		Corpus and Uterus <sup>+</sup>				
	Kidney and Renal Pelvis <sup>+</sup>					



RELATIVE RISK ↓	Merrimack v. SEER	Merrimack v. Sanford	Merrimack v. Auburn	Merrimack v. South Portland	Merrimack v Colchester	Merrimack v. Bennington
	Mesothelioma **	Testes <sup>+</sup>	Melanoma <sup>+</sup>	Mesothelioma <sup>+</sup>	Colon**	None
	Esophagus **	Thyroid**	Kidney and Renal Pelvis <sup>+</sup>	Thyroid**	Prostate**	
	Thyroid **	Cervix <sup>+</sup>	Mesothelioma <sup>+</sup>	Prostate**	Bladder <sup>+</sup>	
	Bladder **	Prostate <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Colon <sup>+</sup>	Lung and Bronchus <sup>+</sup>	
	Kidney and Renal Pelvis <sup>+</sup>	Colon**	Thyroid <sup>+</sup>	Kidney and Renal Pelvis <sup>+</sup>	Female Breast <sup>+</sup>	
	Brain and other CNS <sup>+</sup>	Female Breast**	Corpus and Uterus <sup>+</sup>		No VT Data for Mesothelioma, Kidney, Thyroid and Esophagus	
	Leukemia <sup>+</sup>	Esophagus <sup>+</sup>	Prostate <sup>+</sup>		Legend	
	Larynx <sup>+</sup>	Melanoma <sup>+</sup>	Esophagus <sup>+</sup>		1. Relative risk for each cancer by comparator town (purple shading) arranged by decreasing relative risk ratio (top to bottom).	
	Colon <sup>+</sup>	Multiple Myeloma <sup>+</sup>	Oral Cavity and Pharynx <sup>+</sup>		2. ** Statistically significant increased relative risk.	
	Melanoma <sup>+</sup>	Brain and Other CNS <sup>+</sup>	Testes <sup>+</sup>		3. +Elevated relative risk.	
		Non-Hodgkin Lymphoma <sup>+</sup>				
		Corpus and Uterus <sup>+</sup>				
	Kidney and Renal Pelvis <sup>+</sup>					

# Findings

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PFOA serum levels for a small set of residents in an impacted area are twice the national average.

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Comparing one impacted community cancer incidence to a state average with above average rates may not tell the whole story.

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Merrimack residents are more at risk for developing **mesothelioma, and esophageal, bladder, and thyroid cancers** when compared with national averages.

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When compared with national averages, residents are at increased risk for **developing colon, laryngeal, kidney and renal, brain and CNS cancers and leukemia.**

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Relative risks for **thyroid, prostate, kidney and renal and colon** cancers are higher when compared with three comparator towns in Maine and one in Vermont.

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Relative risks were similar when comparing **Merrimack with Bennington, VT.**

## Town/State Tobacco Use<sup>1</sup>

Merrimack NH <sup>2</sup>	14.80%
Maine	18.6%
New Hampshire	17.3%
Vermont	18.2%

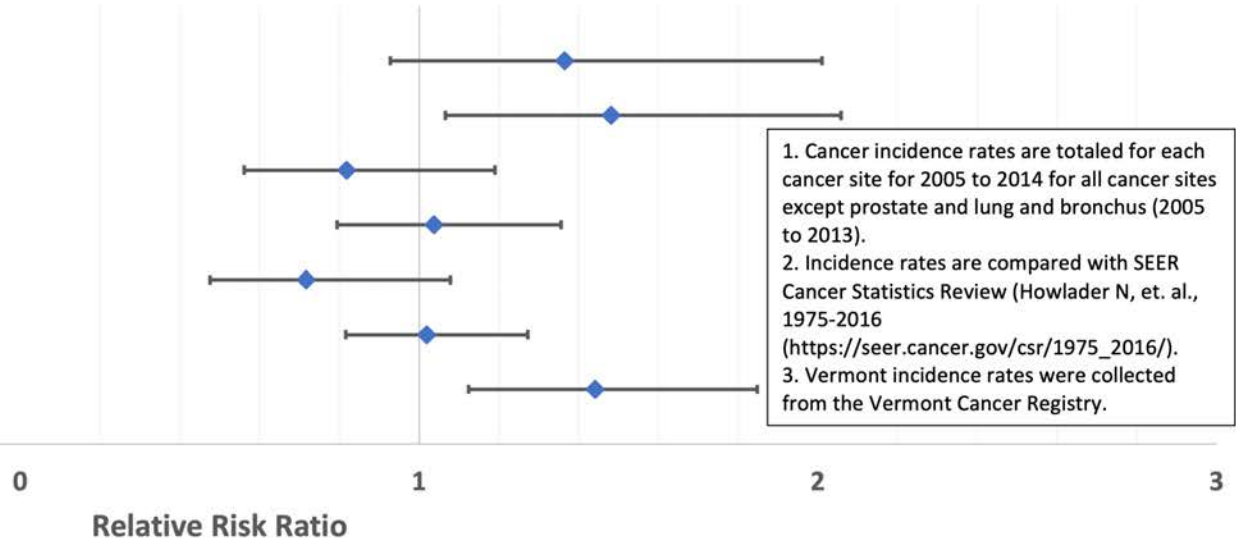
1- State Data on Tobacco Prevalence: [Odani S, Armour BS, Graffunder CM, Willis G, Hartman AM, Agaku IT. State-Specific Prevalence of Tobacco Product Use Among Adults — United States, 2014–2015. MMWR Morb Mortal Wkly Rep 2018;67:97–102.](#)

2 Merrimack data from NHDHHS WISDOM Portal - [https://wisdom.dhhs.nh.gov/wisdom/#CommunityProf\\_FCCEB3C34178419782F0E98A50A8ABBF](https://wisdom.dhhs.nh.gov/wisdom/#CommunityProf_FCCEB3C34178419782F0E98A50A8ABBF) Anon

**POTENTIAL  
CONFOUNDERS**

### Relative Risk Ratio For Merrimack NH v. Colchester, VT (2005 to 2014)

Bladder\*  
Colon\*\*  
Melanoma  
Lung and Bronchus\*  
Non-Hodgkin Lymphoma  
- Female Breast\*  
Prostate\*\*

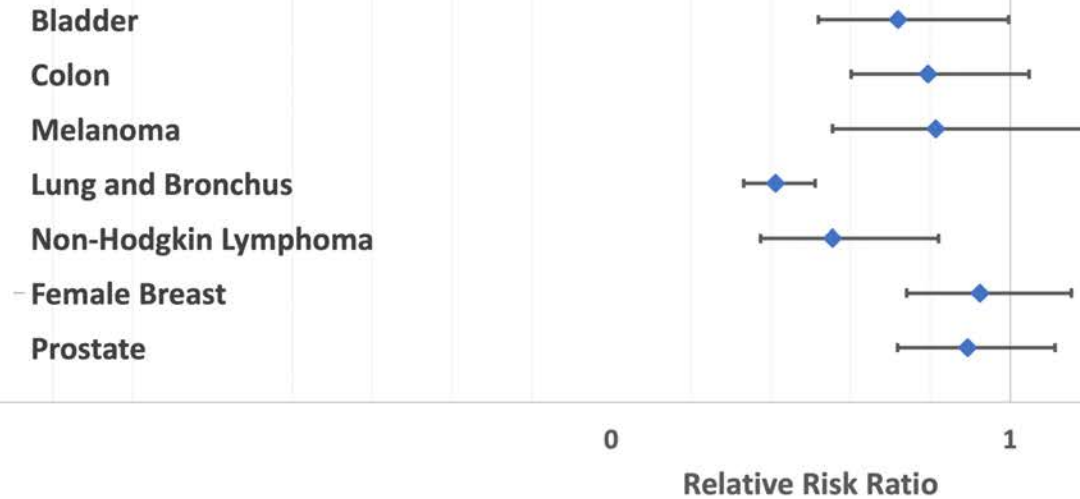


1. Cancer incidence rates are totaled for each cancer site for 2005 to 2014 for all cancer sites except prostate and lung and bronchus (2005 to 2013).  
2. Incidence rates are compared with SEER Cancer Statistics Review (Howlander N, et. al., 1975-2016 ([https://seer.cancer.gov/csr/1975\\_2016/](https://seer.cancer.gov/csr/1975_2016/))).  
3. Vermont incidence rates were collected from the Vermont Cancer Registry.

# RELATIVE RISK RATIOS – COLCHESTER, VT



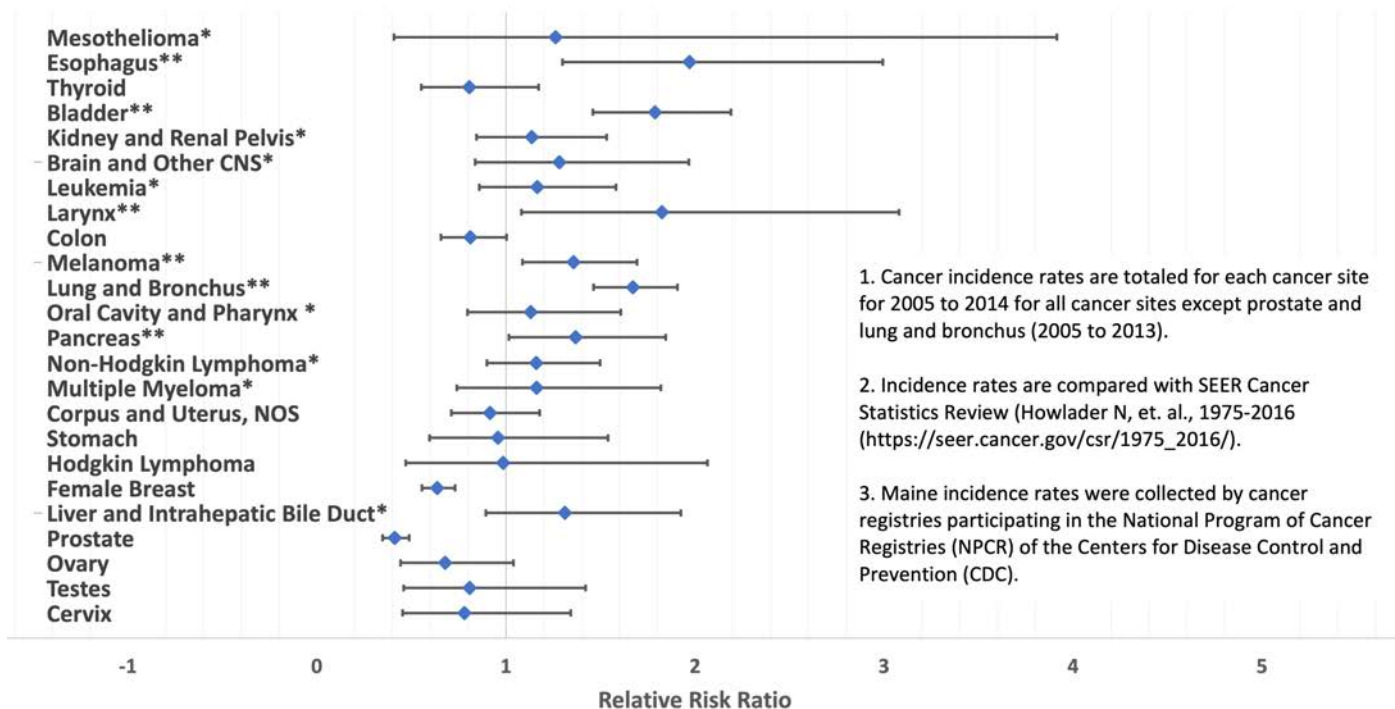
### Relative Risk Ratio For Merrimack NH v. Bennington, VT (2005 to 2014)



1. Cancer incidence rates are totaled for each cancer site for 2005 to 2014 for all cancer sites except prostate and lung and bronchus (2005 to 2013).  
2. Incidence rates are compared with SEER Cancer Statistics Review (Howlader N, et. al., 1975-2016 ([https://seer.cancer.gov/csr/1975\\_2016/](https://seer.cancer.gov/csr/1975_2016/))).  
3. Vermont incidence rates were collected from the Vermont Cancer Registry.

# RELATIVE RISK RATIOS – BENNINGTON, VT

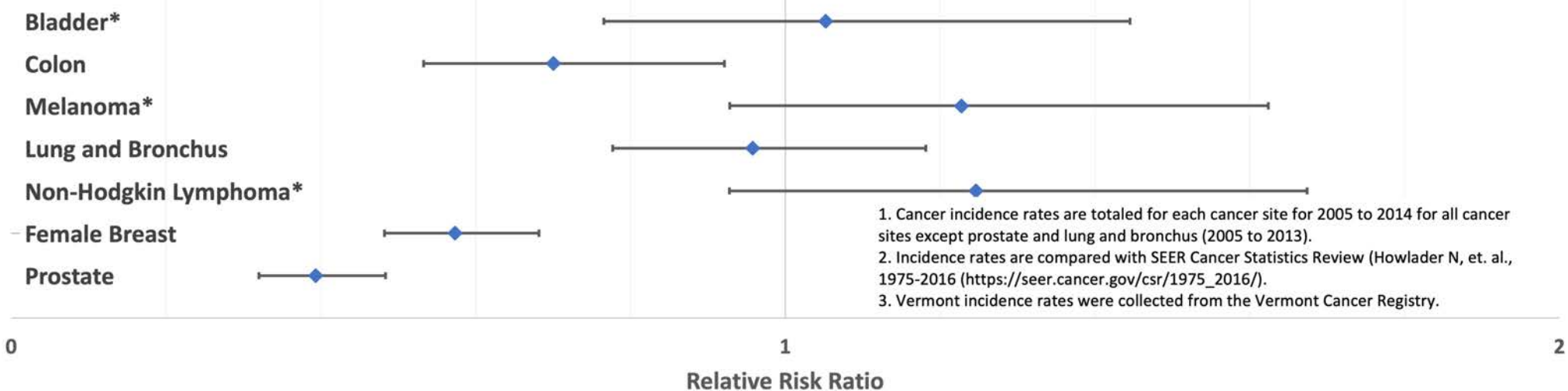
Relative Risk Ratio For South Portland, ME v. SEER (2005 to 2014)



1. Cancer incidence rates are totaled for each cancer site for 2005 to 2014 for all cancer sites except prostate and lung and bronchus (2005 to 2013).
2. Incidence rates are compared with SEER Cancer Statistics Review (Howlander N, et. al., 1975-2016 ([https://seer.cancer.gov/csr/1975\\_2016/](https://seer.cancer.gov/csr/1975_2016/))).
3. Maine incidence rates were collected by cancer registries participating in the National Program of Cancer Registries (NPCR) of the Centers for Disease Control and Prevention (CDC).

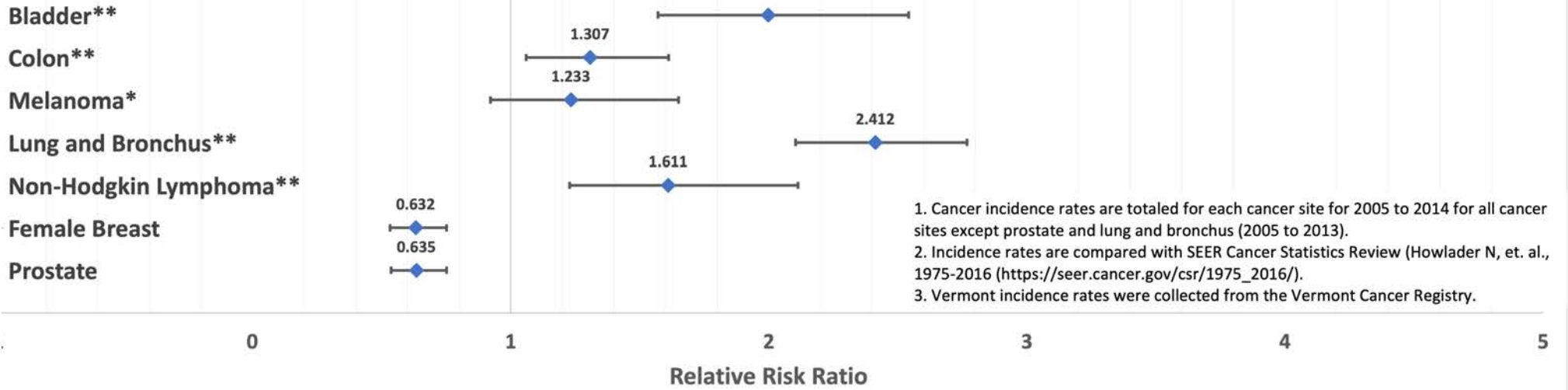
# RELATIVE RISK RATIOS –SOUTH PORTLAND, ME

### Relative Risk Ratio For Colchester, VT v. SEER (2005 to 2014)



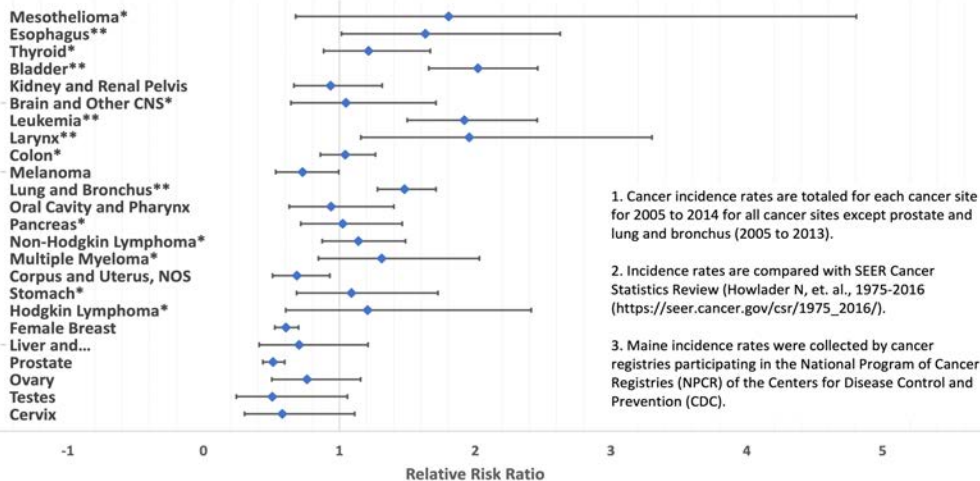
# RELATIVE RISK RATIOS – COLCHESTER, VT

### Relative Risk Ratio For Bennington, VT v. SEER (2005 to 2014)

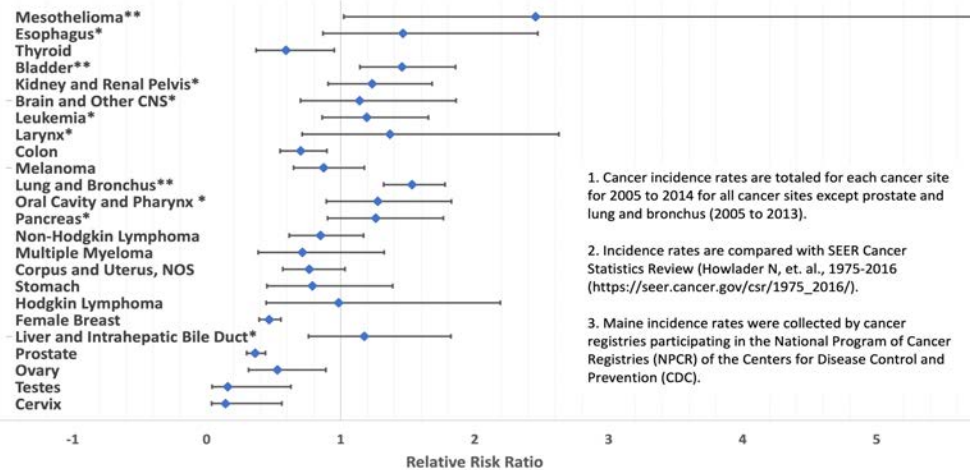


# RELATIVE RISK RATIOS – BENNINGTON, VT

Relative Risk Ratio For Auburn, ME v. SEER (2005 to 2014)



Relative Risk Ratio For Sanford, ME v. SEER (2005 to 2014)



# RELATIVE RISK RATIOS –AUBURN AND SANFORD, ME