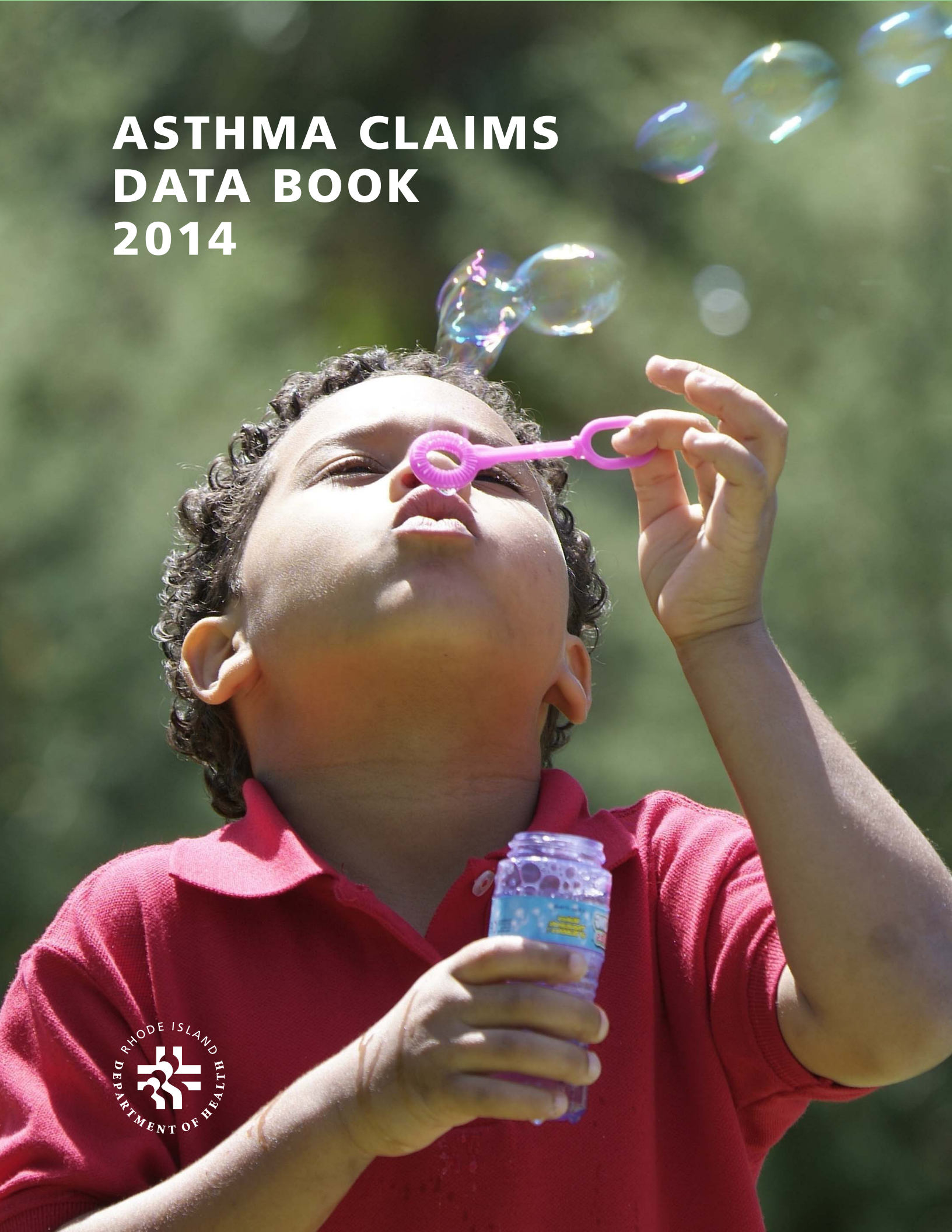


ASTHMA CLAIMS DATA BOOK 2014



This publication was supported by the Cooperative Agreement Number 5U59EH000524-05 from The Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

Introduction

This report represents the culmination of a two year partnership between the Rhode Island Department of Health's Asthma Control Program and The Providence Plan. The scope of this project was to compile asthma claims data for Rhode Island children between the ages of 2 and 17 years old and to express asthma claims prevalence and healthcare utilization patterns for childhood asthma within a geographic context. Claims data spanning the years 2010-2012 were provided by Blue Cross Blue Shield of Rhode Island, Neighborhood Health Plan of Rhode Island, and United Healthcare of New England.

This project affords Rhode Island an unprecedented opportunity to understand the geography of asthma. This includes identifying communities where children who have sought medical care for asthma are most prevalent, mapping areas where higher rates of children with asthma are seeking emergency department care or are hospitalized for asthma, and mapping the proximity of asthma incidence to some of the socioeconomic and physical determinants of health: poverty and housing. This report also examines rates of chronic absenteeism among public school students with asthma claims.

Understanding the geography of asthma is important for the following reasons:

1. Exposure to the factors that trigger asthma depends largely on where people live and the resources at their disposal to remove or reduce exposure to those factors;
2. Mapping the prevalence of asthma in small areas facilitates the identification of at-risk populations;
3. An enhanced understanding of where at-risk populations are located can guide decision making on policy interventions and funding to optimize the impact of these resources on asthma control.

About the Data

A detailed description of the data can be found in Appendix A.1. The claims data yielded information on 26,827 Rhode Island resident children between the ages of 2 and 17 years old. These are children who sought care for asthma in a physician office, emergency department, or hospital inpatient setting at least once during the period 2010-2012.

Geographic Levels of Analysis

Census tracts were chosen as the primary geographic level of analysis. Census tracts are small areas defined by the U.S. Census Bureau and usually average about 4,000 residents. There are 241 census tracts in Rhode Island. Detailed mapping is also presented for the following cities: Central Falls, Pawtucket, Providence, and Woonsocket. We focus on these cities due to their status as "core cities." Core cities are defined by Rhode Island KIDS COUNT as cities in which 25% or more of children under

the age of 18 live below poverty. Detailed maps are also presented for Newport and West Warwick. Newport and West Warwick are no longer considered core cities. This is due to changes in the poverty threshold for core city status—from 15% to 25%—and changes in the way income data are collected by the U.S. Census Bureau, which render childhood poverty estimates for these cities less reliable.

This report illuminates the geographic context of asthma by adding a neighborhood perspective. Neighborhood boundaries are overlaid on the maps displaying the asthma data for the core cities, Newport, and West Warwick to furnish readers with a better understanding of which communities bear the greatest burden of childhood asthma.

Key Findings

- Statewide asthma claims prevalence among children ages 2-17 years old for the period 2010-2012 was 12.8%
- The highest average annual rates of asthma claims prevalence in children ages 2-17 years old prevail in Rhode Island's core cities: Central Falls, Pawtucket, Providence, and Woonsocket. Parts of Newport and West Warwick also display high rates of children with asthma claims.
- Asthma tends to be located in areas where there are high rates of poverty among children.
- There is a strong spatial association between asthma claims prevalence and the location of public housing.

Data Preview

The Providence Plan possesses a wide range of geo-analytical and statistical tools. Information on data management and methodology is provided in Appendix A.1 at the end of this report. The geographic representations of the asthma data presented herein fall into two classes:

1. Choropleth Maps: These maps display information for geographic areas by dividing the distribution of a statistic of interest, such as *claims prevalence*, into a defined number of ranges and using a color scheme to shade each geographic area according to which range of the statistic its value resides.

For rates and percentages, choropleth maps face a limitation in that they fail to adequately reflect the spatial distribution of residences, or where children with asthma claims actually live. This is important because some geographic areas contain large swaths of public recreation lands, waterways, or areas zoned for commercial or industrial activity that constrain where people can live. To better reflect the spatial distribution of residences we use density maps.

2. Density Maps: Asthma densities supply a spatial representation of where children with asthma live. Density plots are based on the individual data points that emerge from representing children with asthma as points on a map according to their residential addresses. These maps help locate areas within larger communities or neighborhoods where children with asthma tend to cluster.

Plan of the Report

This report is structured as follows. Section 1 provides geographic analyses of asthma claims prevalence and utilization of emergency department and hospital inpatient care for asthma. Section 2 provides analysis that illuminates the relationship between asthma and poverty among children. Section 3 examines the relationship between housing factors and asthma. Section 4 provides maps of chronic absenteeism among public school students who have incurred asthma claims during 2010-12.

1

Asthma Claims Prevalence and Patterns of Acute Care Utilization for Asthma

Asthma Claims Prevalence

Claims prevalence refers to the percentage of children ages 2–17 years old that have had an asthma claim. Statewide asthma claims prevalence for the period 2010-2012 was 12.8%.¹ Figure 1 displays average annual claims prevalence by census tract for the period 2010 - 2012. For each year, the number of children with an asthma claim was computed for each census tract.² The resulting three years of data were then averaged by census tract and divided by the number of children ages 2-17 years old living in the census tract at the time of the 2010 Decennial Census.

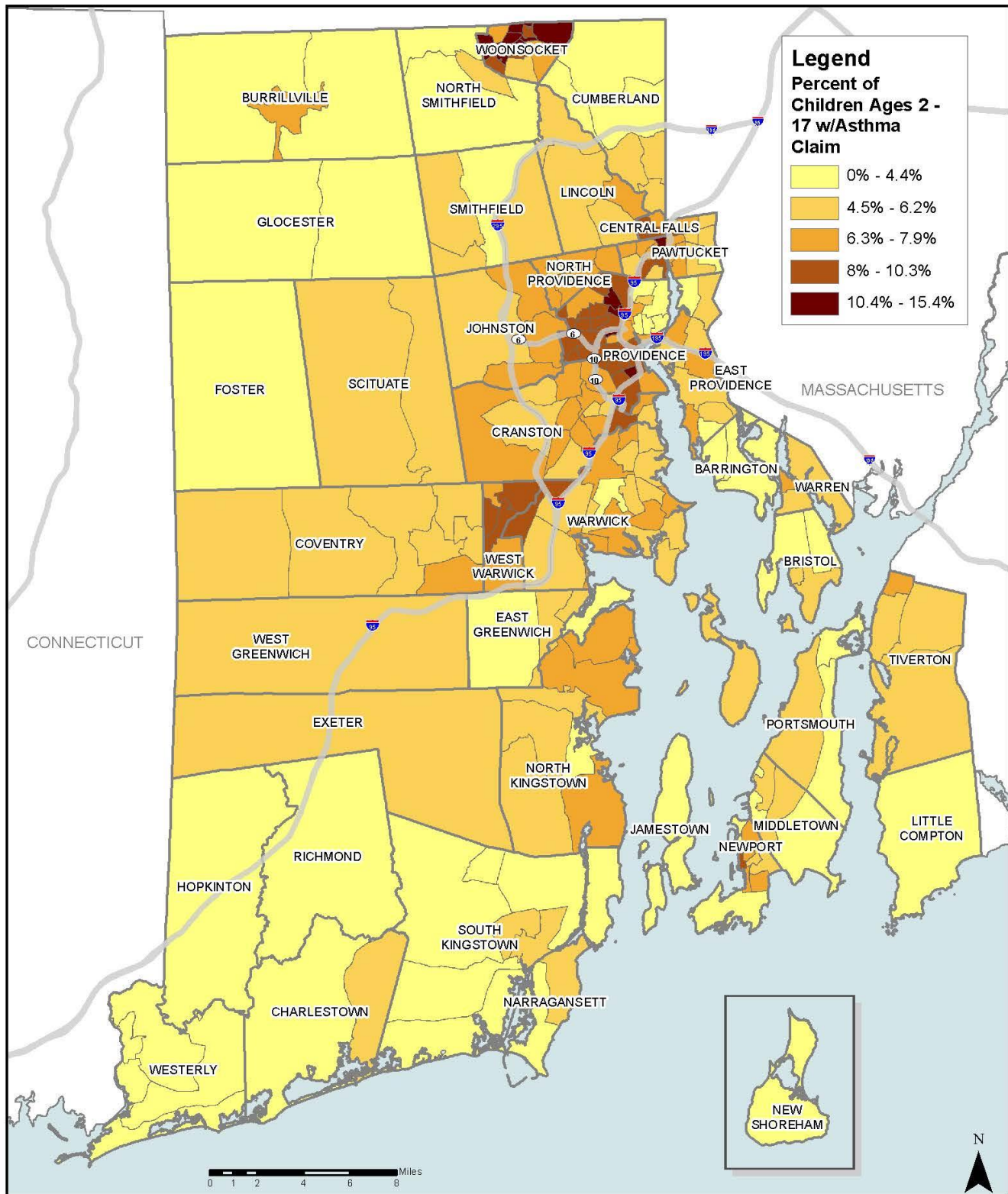
The darker shaded areas in Figure 1 indicate census tracts with higher average claims prevalence. The census tracts with the highest average claims prevalence are located in one of six cities: Central Falls, Newport, Pawtucket, Providence, West Warwick or Woonsocket. Figures 2 and 3 present average claims prevalence and asthma density plots, respectively, for Rhode Island's four core cities. Figures 4 and 5 display the same information for Newport and West Warwick.

¹ This percent was obtained by dividing the number of children with an asthma claim for period 2010-2012 by the number of children ages 2-17 years old living in the state at the time of the 2010 Decennial Census.

² See Appendix A.1 for an explanation of methods for giving the claims data a geographic representation.

Figure 1

Percent of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
Three-Year Average



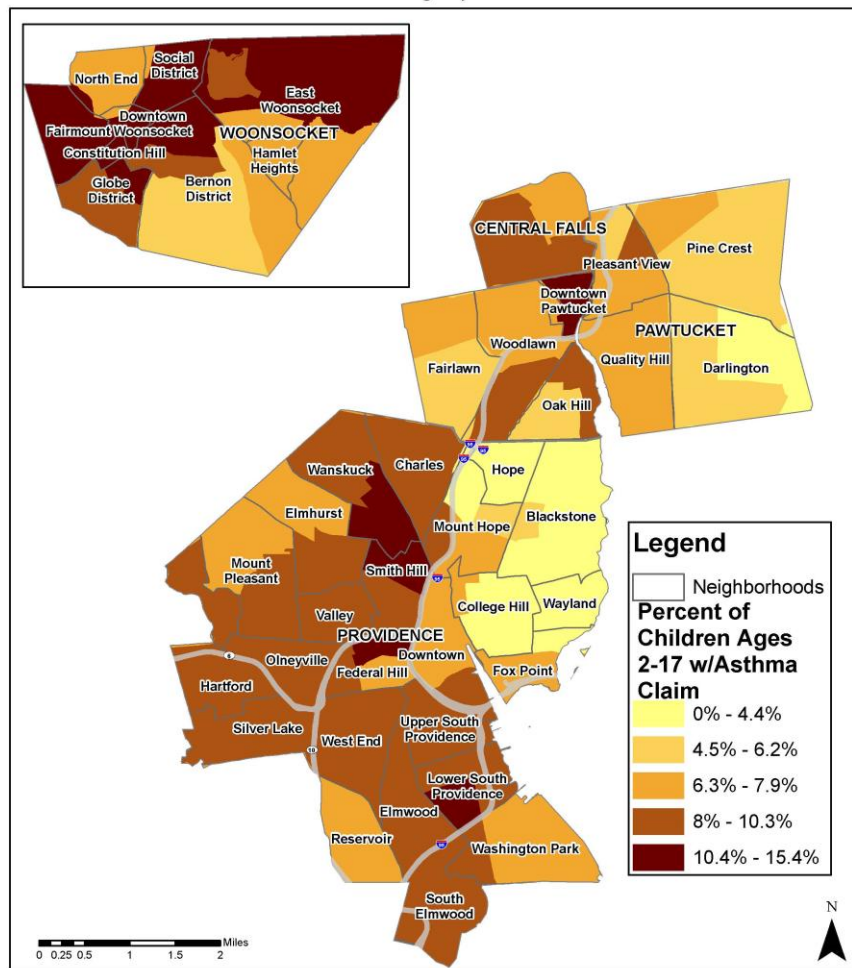
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 2

Percent of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
Three-Year Average by Census Tract



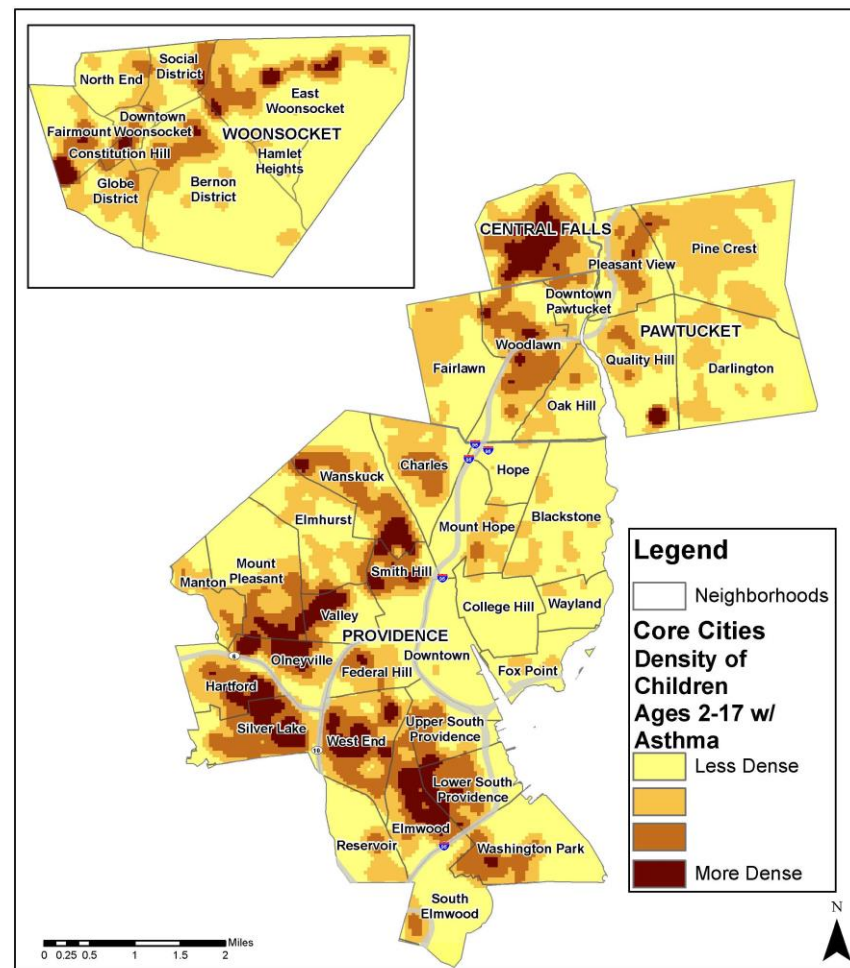
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

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Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 3

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012



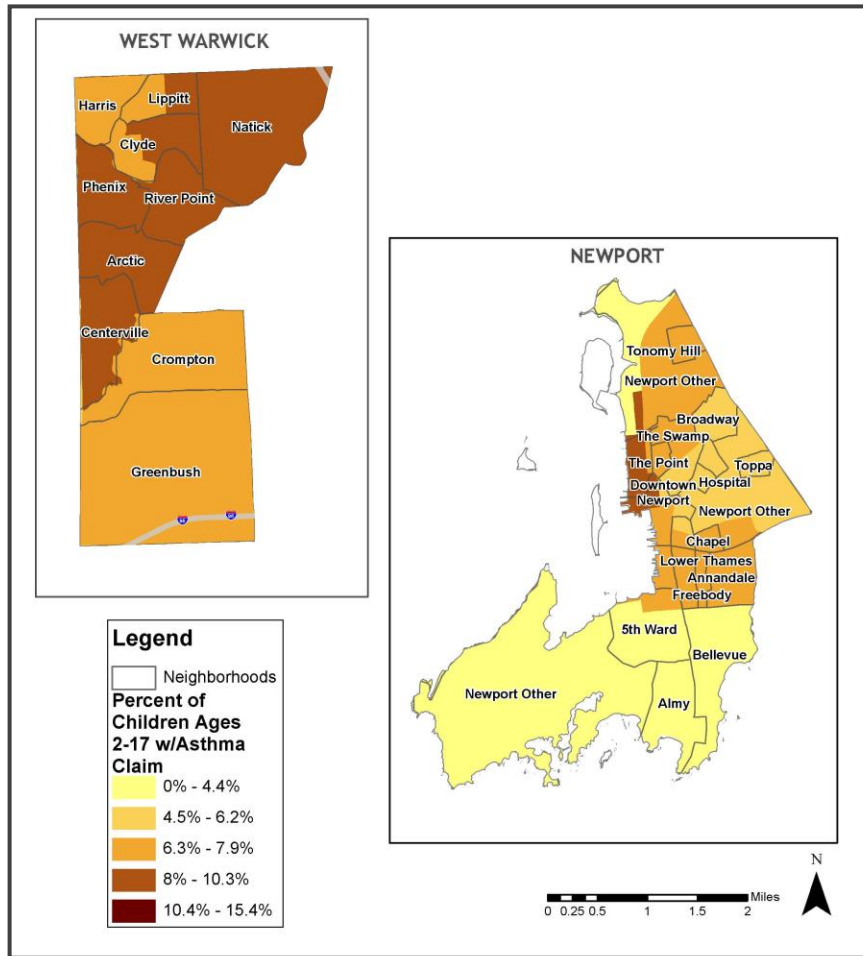
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Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 4

Percent of Children Ages 2-17 with an Asthma Claim*, 2010-2012, Three-Year Average



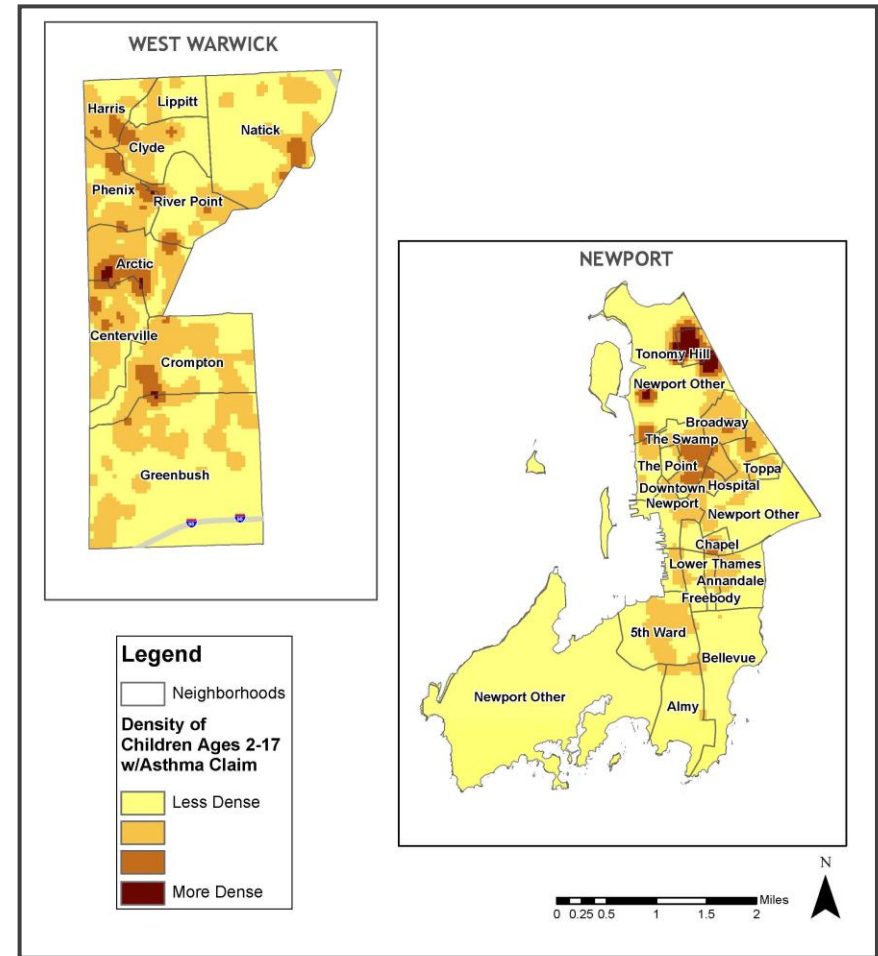
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 5

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Emergency Department and Hospital Utilization for Children with Asthma

Emergency Department Encounters

Asthma is a chronic disease which, if poorly managed, may advance to a level of severity that requires acute care in an emergency department (ED) or hospital inpatient setting. ED visits and hospitalizations for asthma are costly and potentially avoidable.

In total, 2,157 of the 26,827 children experienced an ED visit for which asthma was listed as the primary diagnosis. This represents 8% of the total. Table 1 shows numbers of ED visits with counts of children who had the associated number of visits. 1,669 children, or 6.2% of the total, had one ED visit. 488 children, or 1.8%, experienced two or more ED visits.

Table 1
Asthma Emergency Department Visits for Rhode Island Children
2010 – 2012 Combined Data

Number of Visits	Number of Children	Percent of Children with Asthma Claim
0	24,670	92.0%
1	1,669	6.2%
2	323	1.2%
3	106	0.4%
4	32	0.1%
5	16	<0.1%
6	5	<0.1%
7	3	<0.1%
9	1	<0.1%
10	2	<0.1%
Total	26,827	100.0%

Data Sources: Blue Cross Blue Shield of Rhode Island, Neighborhood Health Plan of Rhode Island, and United Healthcare of New England. An ED visit for asthma was determined by the presence of a primary diagnosis code for asthma (ICD-9-CM 493.xx) on any ED claims form.

The geographic analysis of ED and hospital utilization for asthma proceeds similarly to the analysis of claims prevalence, but with important caveats. Unlike the claims prevalence analysis, which represents a three-year average of the percent of children ages 2-17 years old that have had an asthma claim, the ED utilization and inpatient utilization analyses relied on pooling the data across the three years. For the utilization analyses, the denominator is children ages 2-17 years old who have had an asthma claim. Children with asthma claims were assigned to census tracts based on the address associated with their longest period of health plan enrollment to obtain the number of

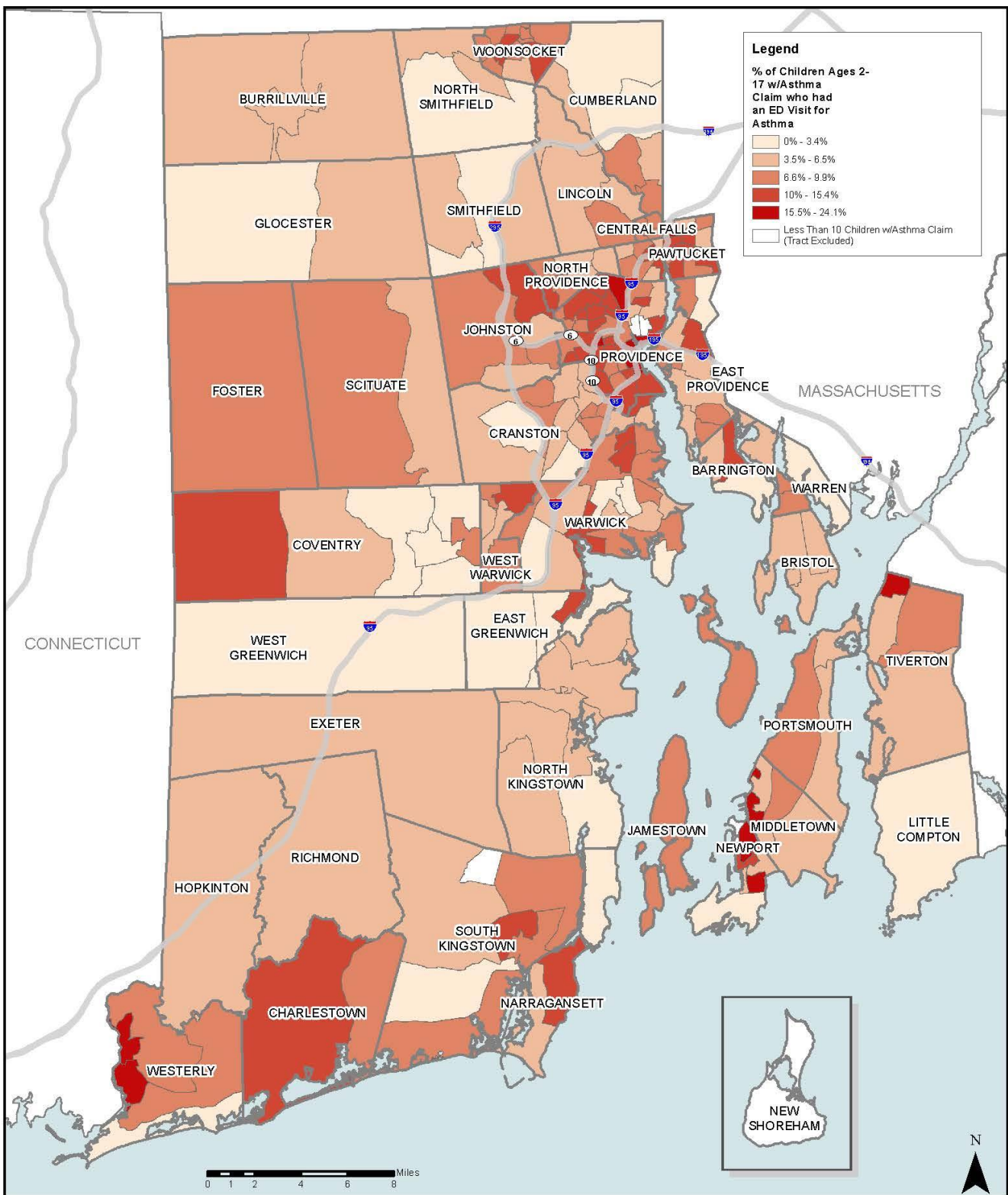
children with an asthma claim per census tract. Census tracts with fewer than 10 children with an asthma claim were suppressed. The next step was to determine the percentage of children with asthma claims who had at least one ED visit or at least one hospitalization, per census tract.

Census tracts with the highest percentages of children with asthma claims who had at least one ED visit are more geographically dispersed than census tracts with high claims prevalence, as shown in Figure 6. For example, tracts in Newport, Providence, Westerly, and Tiverton exhibit some of the highest percentages. Some census tracts have low numbers of children with asthma claims, which may result in a high percentage of asthmatic children with an ED visit while exhibiting a low overall number of these cases.

To highlight areas where there are more cases of children with asthma utilizing emergency department care, density plots of children with an asthma claim who had at least one ED visit between 2010 and 2012 are provided. Figures 7 and 8 present ED utilization maps for the core cities. Figures 9 and 10 present ED utilization maps for Newport and West Warwick.

Figure 6

Percent of Children Ages 2-17 with an Asthma Claim*
who had an Asthma Emergency Department Visit**, 2010-2012



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

** Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

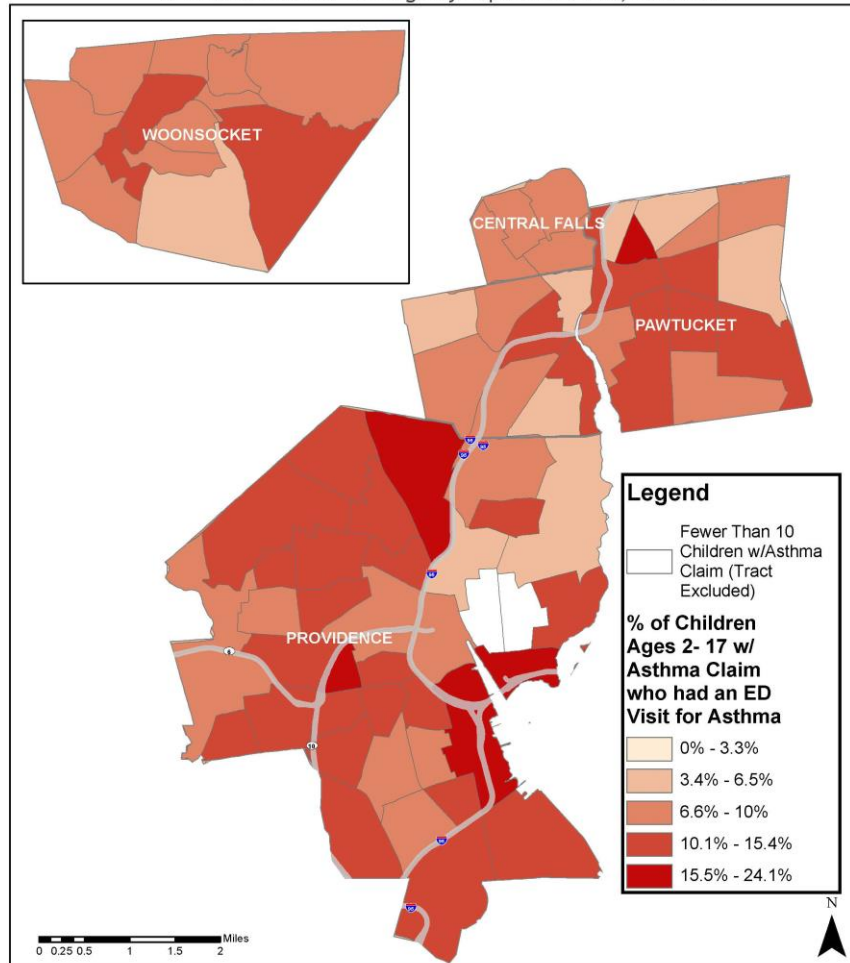
Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 7

Percent of Children Ages 2-17 with Asthma*
who had an Asthma** Emergency Department Visit, 2010-2012



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

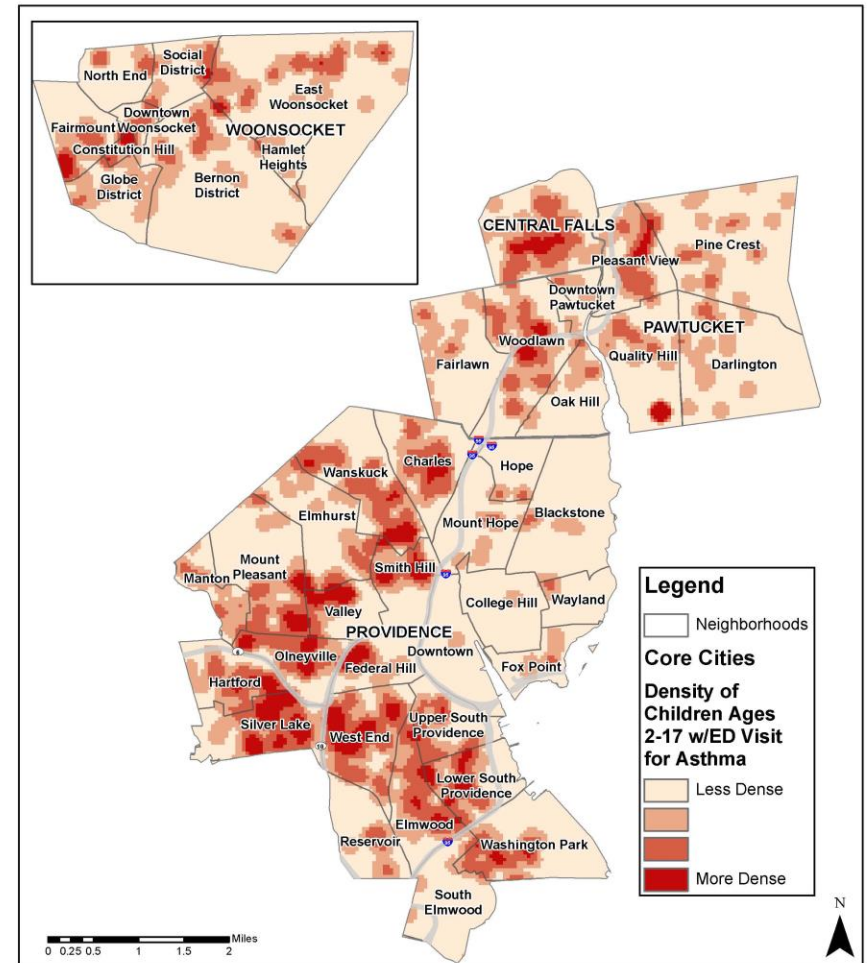
** Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
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Rhode Island Geographic Information System (RIGIS),
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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 8

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012



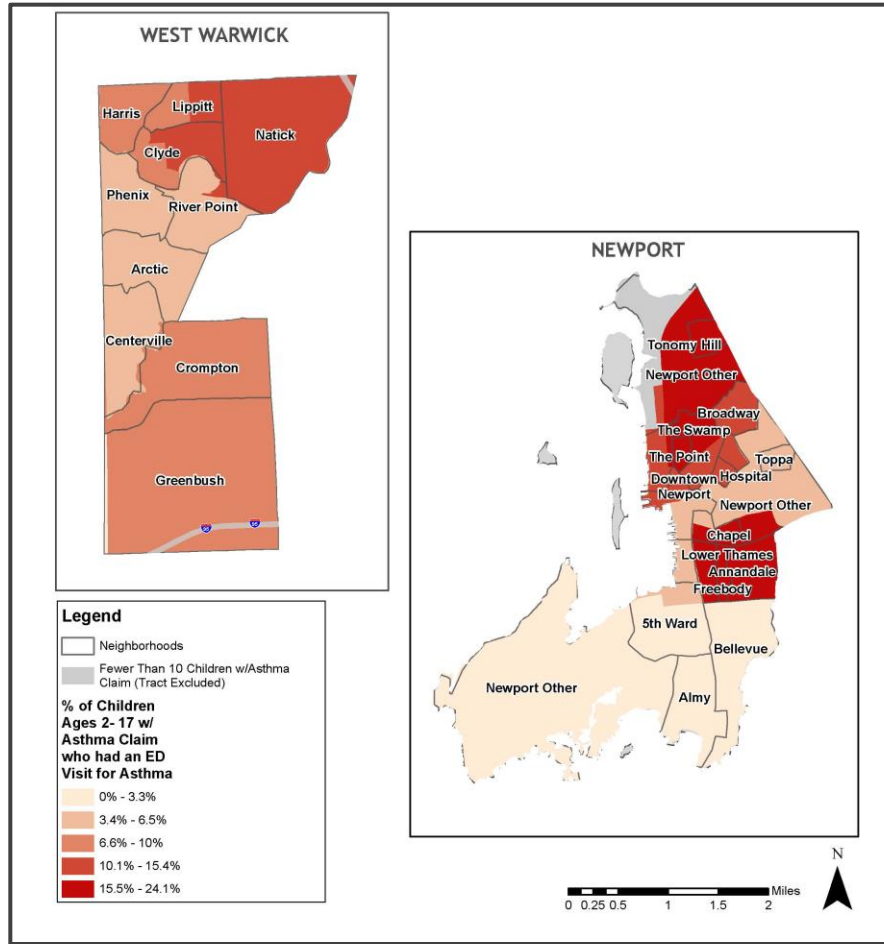
* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 9

Percent of Children Ages 2-17 with an Asthma Claim*
who had an Asthma Emergency Department Visit**, 2010-2012



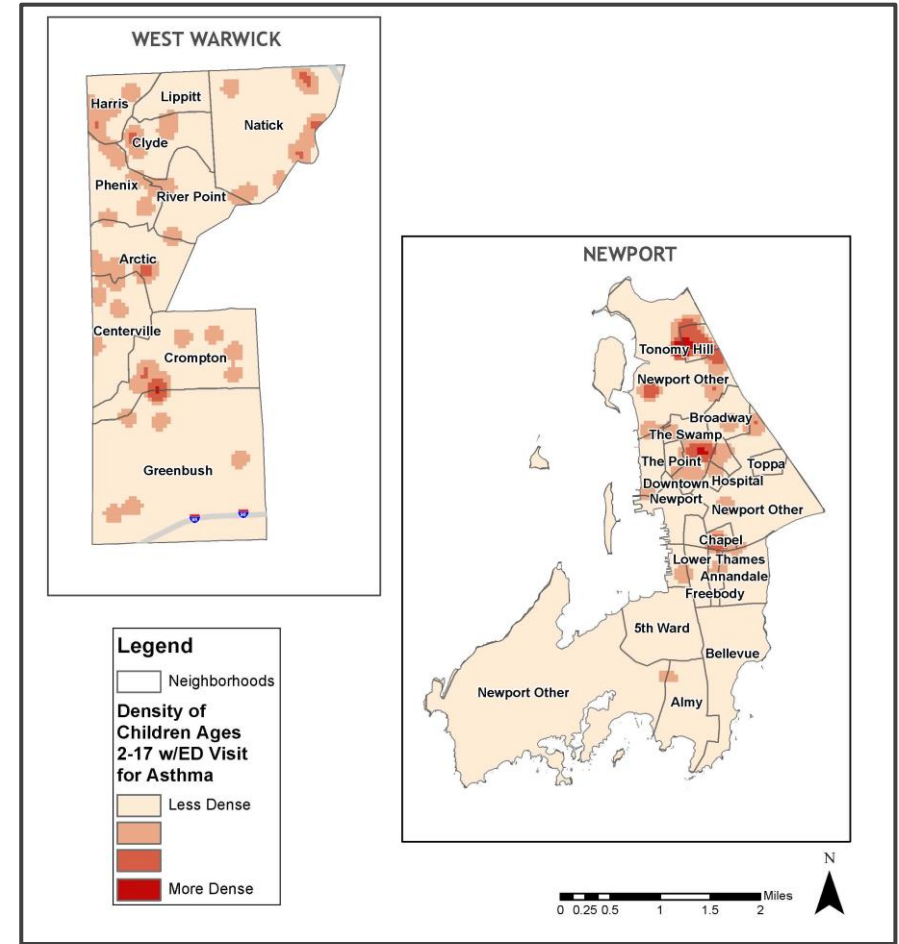
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx
** Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 10

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012



* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Hospitalizations for Asthma

Hospitalizations for asthma occur in patients with the most uncontrolled asthma. 440, or 1.6%, of the children for whom we had data experienced at least one hospitalization for asthma, as shown in Table 2.

Table 2
Asthma Hospital Admissions for Rhode Island Children
2010 – 2012 Combined Data

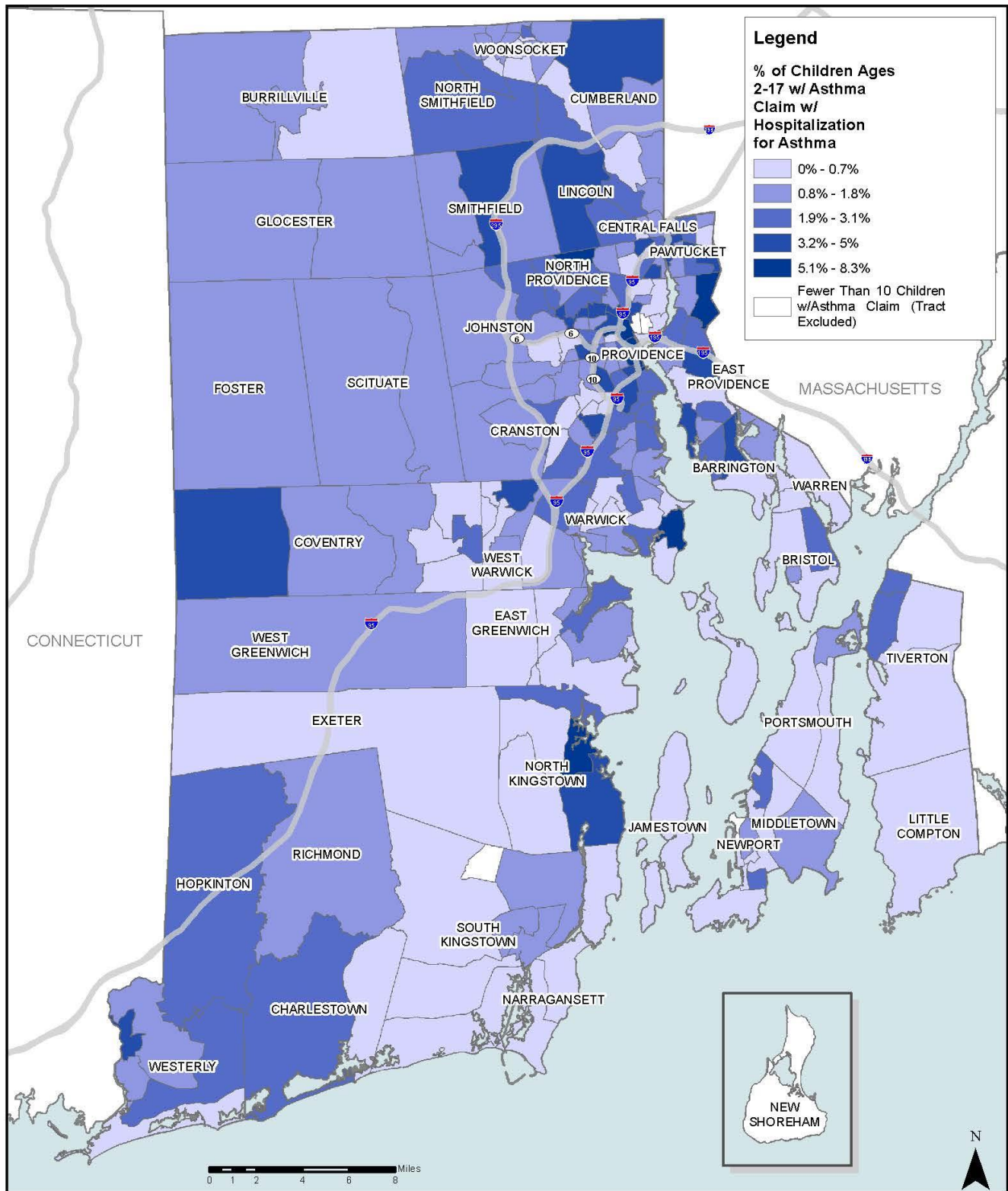
Number of Hospital Admissions	Number of Children	Percent of Children with Asthma Claim
0	26,387	98.4%
1	394	1.5%
2	39	0.1%
3	3	<0.1%
4	1	<0.1%
5	1	<0.1%
6	2	<0.1%
Total	26,827	100.0%

Data Sources: Blue Cross Blue Shield of Rhode Island, Neighborhood Health Plan of Rhode Island, and United Healthcare of New England. A hospitalization for asthma was determined by the presence of a primary diagnosis code for asthma (ICD-9-CM 493.xx) on any inpatient claims form.

Figure 11 displays the percentage of children with an asthma claim who had at least one hospitalization for which asthma was the primary cause. As with Figure 6, there is a great deal of geographic dispersion of tracts with high percentages of children with asthma claims who had a hospitalization for asthma. Part of the reason for this dispersion is low numbers of children with asthma in these census tracts. Due to the small aggregate number of children with an asthma hospitalization, density plots for the core cities, Newport, and West Warwick, could not be constructed. Figures 12 and 13 display the information from Figure 11 for the Core Cities and Newport and West Warwick.

Figure 11

**Percent of Children Ages 2-17 with an Asthma Claim*
who had an Asthma Inpatient Hospitalization**, 2010-2012**



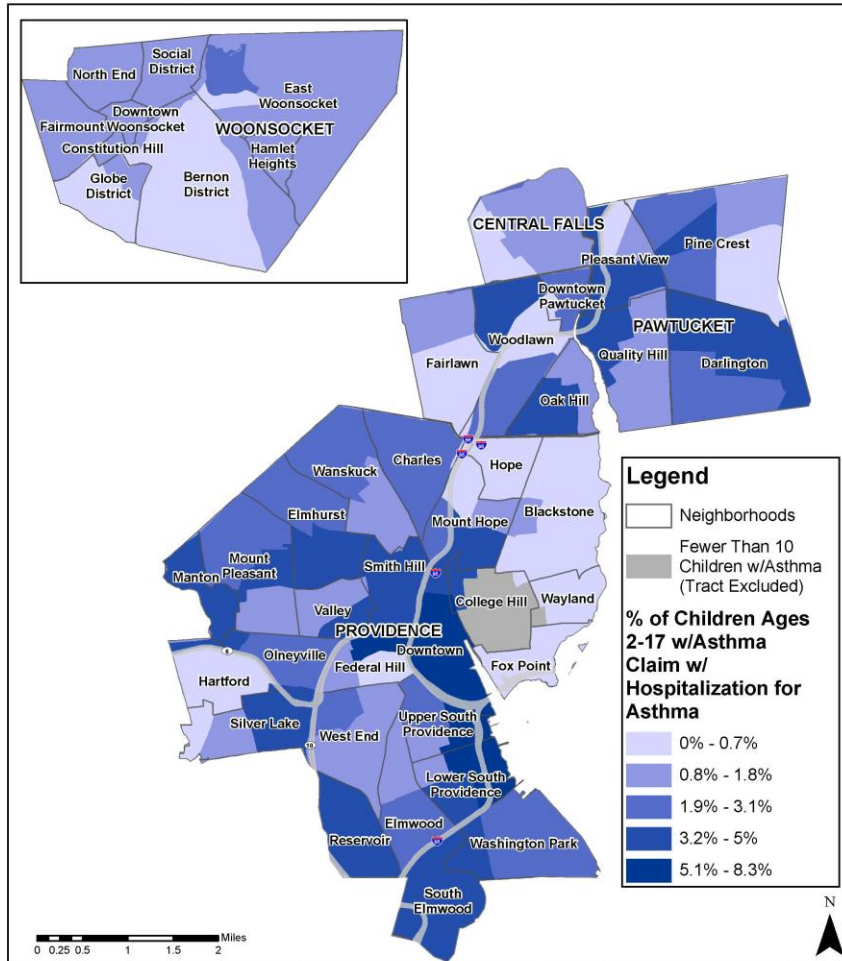
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx
 ** Primary diagnosis of asthma on an Inpatient Hospitalization claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
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 Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
 Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
 For: Rhode Island Department of Health

Figure 12

Percent of Children Ages 2-17 with an Asthma Claim*
who had an Asthma Inpatient Hospitalization**, 2010-2012



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

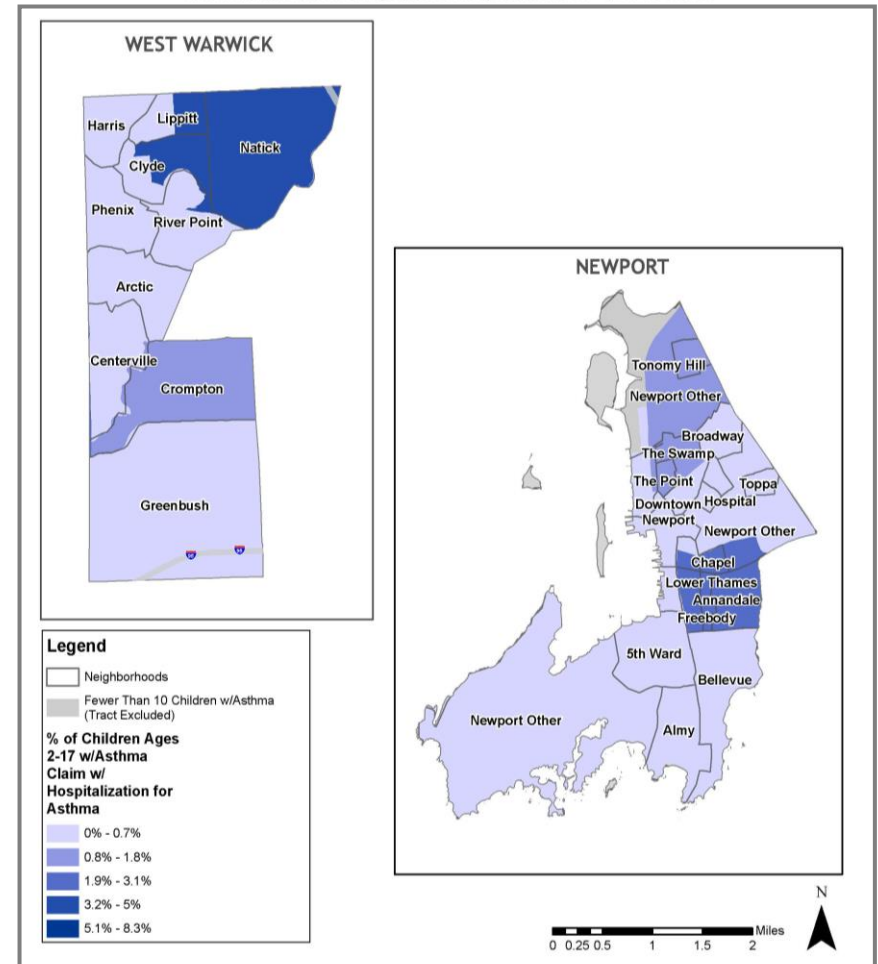
** Primary diagnosis of asthma on an Inpatient Hospitalization claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
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Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 13

Percent of Children Ages 2-17 with an Asthma Claim*
who had an Asthma Inpatient Hospitalization**, 2010-2012



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

** Primary diagnosis of asthma on an Inpatient Hospitalization claims form, ICD-9-CM 493.xx

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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

2

Asthma Claims Prevalence and Poverty

Asthma and Poverty

The incidence of asthma can be associated with a host of socioeconomic factors. Chief among these factors is low-income status, or poverty. Poverty represents a lack of economic resources available to families to remove or reduce exposure to asthma triggers and adequately manage asthma symptoms. In 2012, the poverty income threshold for a family of four was \$23,050¹. Public programs, such as the Supplemental Nutritional Assistance Program (SNAP), Medicaid, and public housing subsidies provide an important safety net for children of low income families. Unfortunately, these programs do not fully mitigate the effects of poverty on the wellbeing of children.

For these reasons, the poverty rate among children under age 18 was chosen as a key socioeconomic indicator for this analysis. Poverty represents socioeconomic deprivation and is correlated with other socioeconomic and physical determinants of health, including unhealthy housing, schools, and communities. There is also a salient geographic component to poverty to the extent that low-income families tend to concentrate in particular communities.

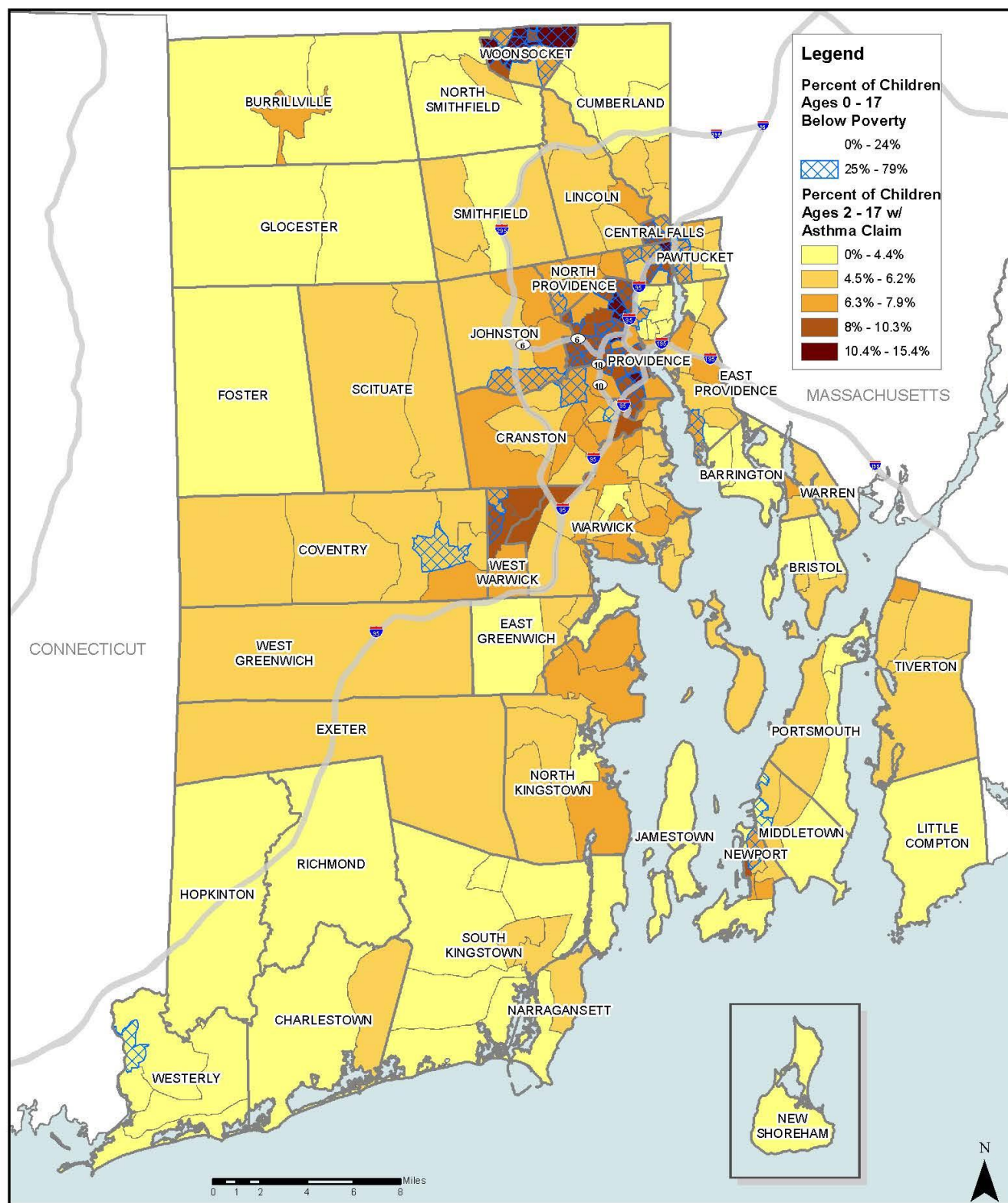
Figures 14 and 15 display asthma claims prevalence and emergency department utilization among children with asthma in the context of childhood poverty. The blue crosshatched areas represent census tracts where 25% or more children live below poverty. Poverty rates among children vary across Rhode Island, with the highest rates of poverty clustering in urban areas. Some areas exhibit childhood poverty rates up to 79%. Appendix A.2 examines this relationship from a more technical perspective.

Figures 16 and 17 show childhood poverty at the census tract level superimposed on density maps of children with an asthma claim and children who had an ED visit for asthma within the core cities. Figures 18 and 19 show the same information for Newport and West Warwick. These maps illuminate a spatial association between the incidence of asthma and poverty. As noted under the principal limitations, the data potentially over represent Medicaid populations. This could strengthen the spatial relationship between poverty rates and asthma densities because more children in low-income areas within Rhode Island's urban areas are represented in the data.

¹ Federal Register, Vol. 77, No. 17, January 26, 2012, pp. 4034-4035

Figure 14

Percent of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
Three-Year Average, with Percent of Children Under 18 Living Below Poverty



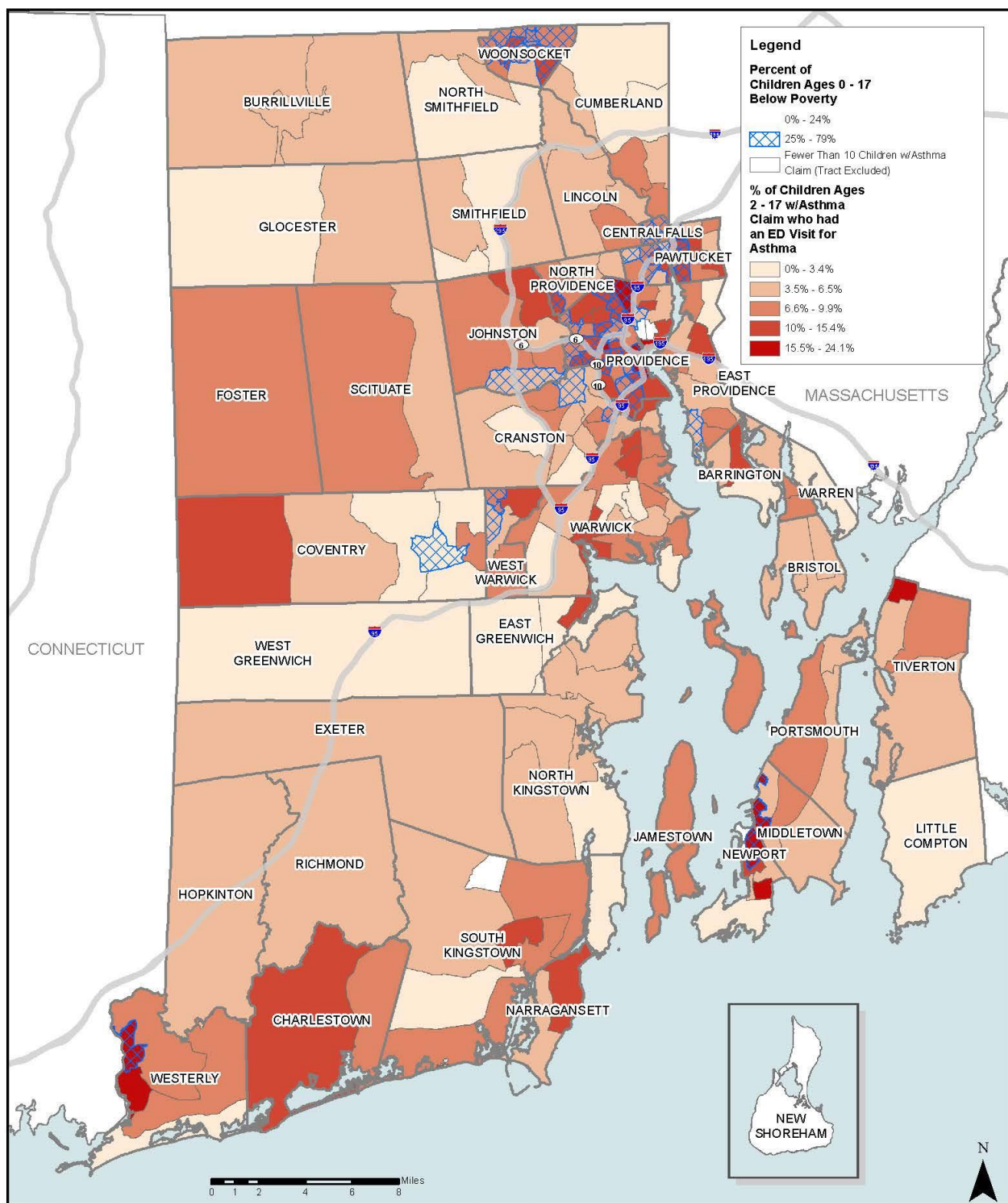
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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 15

Percent of Children Ages 2-17 with an Asthma Claim* who had an Asthma Emergency Department Visit, 2010-2012, with Percent of Children Under 18 Living Below Poverty**



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

** Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

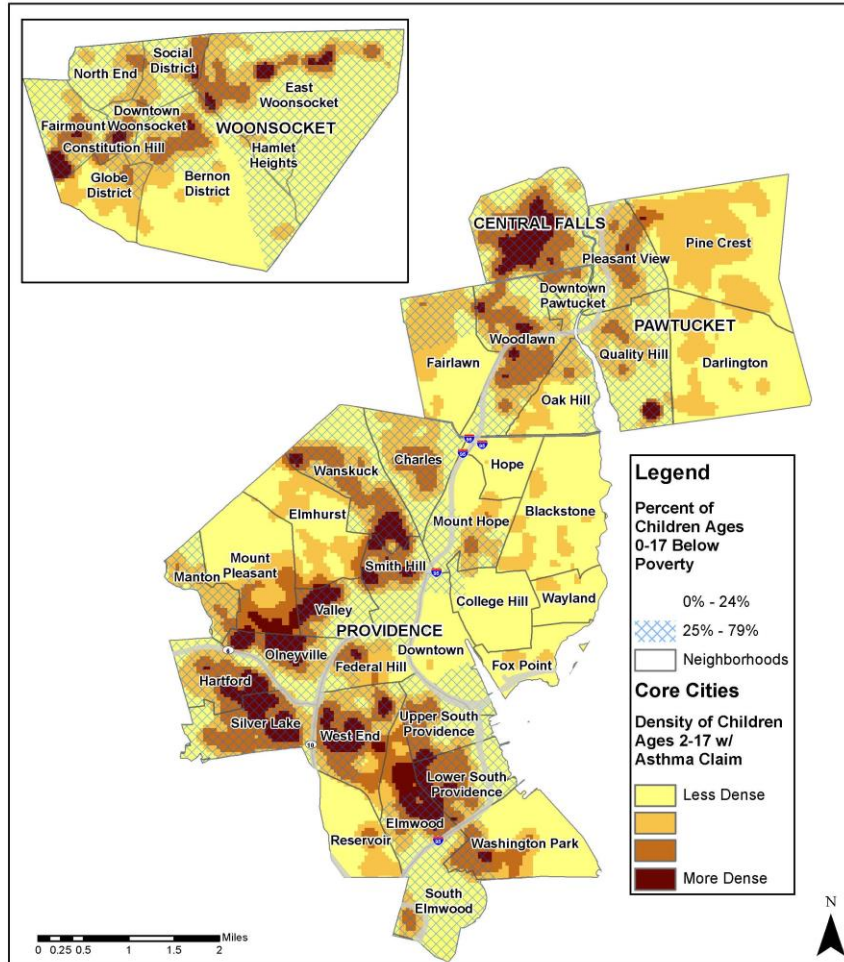
Rhode Island State Plane Feet, NAD83

Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 16

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
with Percent of Children Under 18 Living Below Poverty



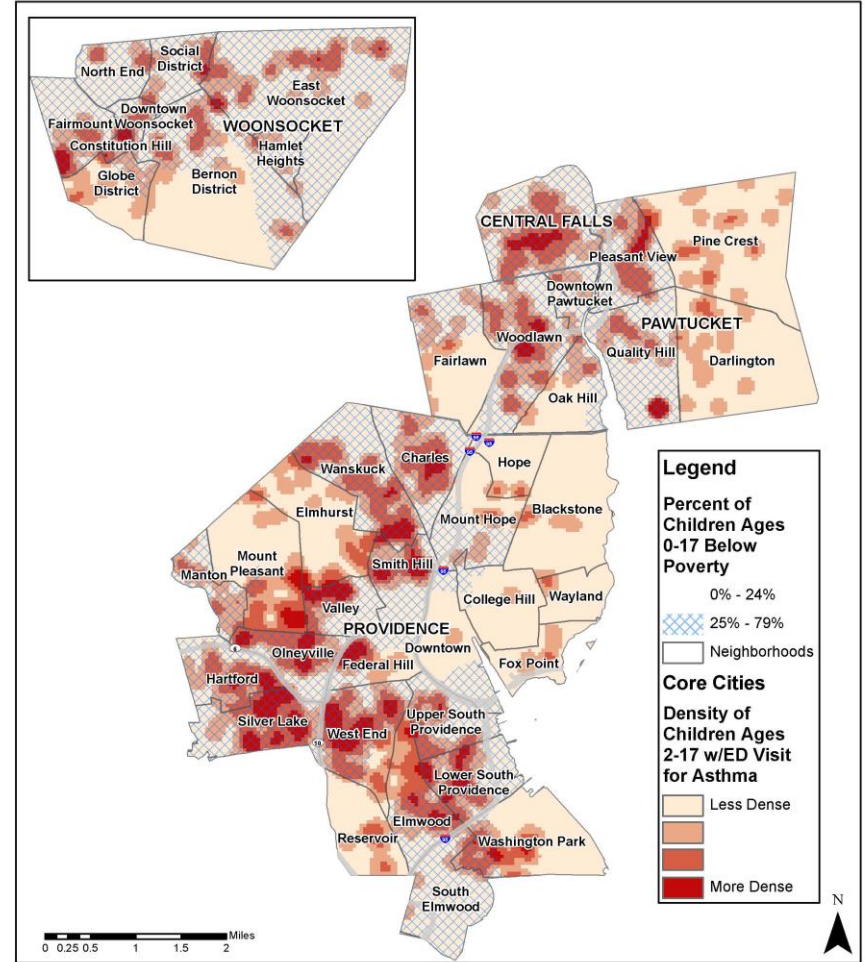
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 17

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012,
with Percent of Children Under 18 Living Below Poverty



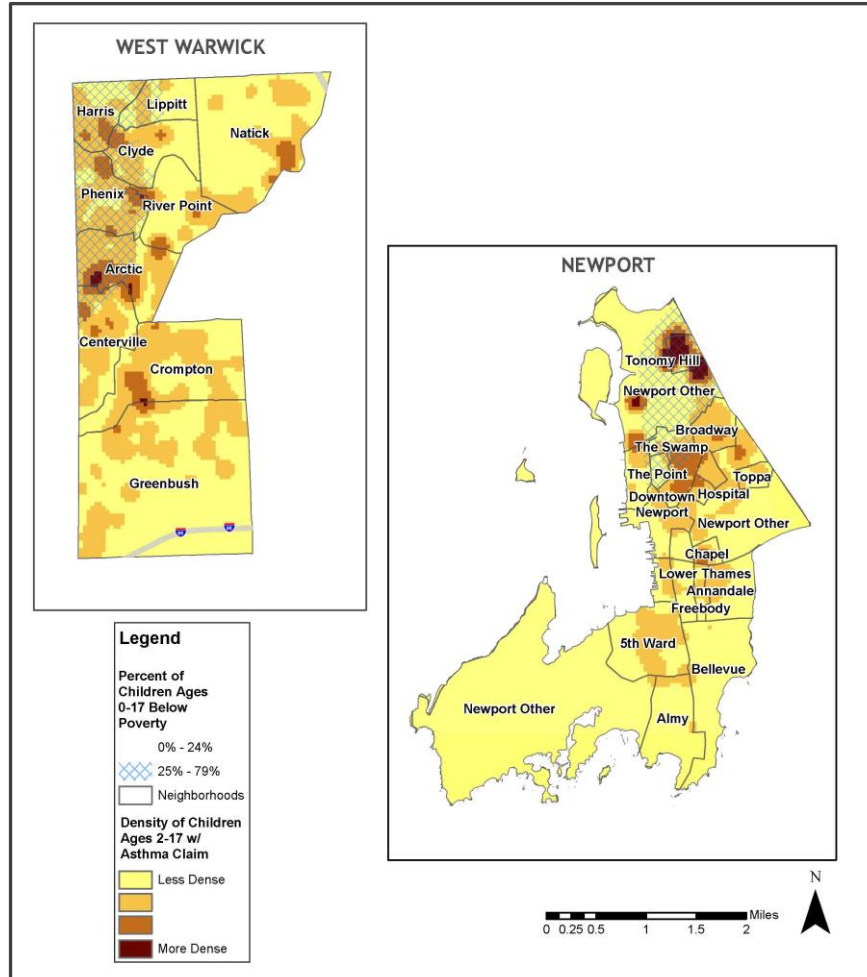
* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 18

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
with Percent of Children Under 18 Living Below Poverty



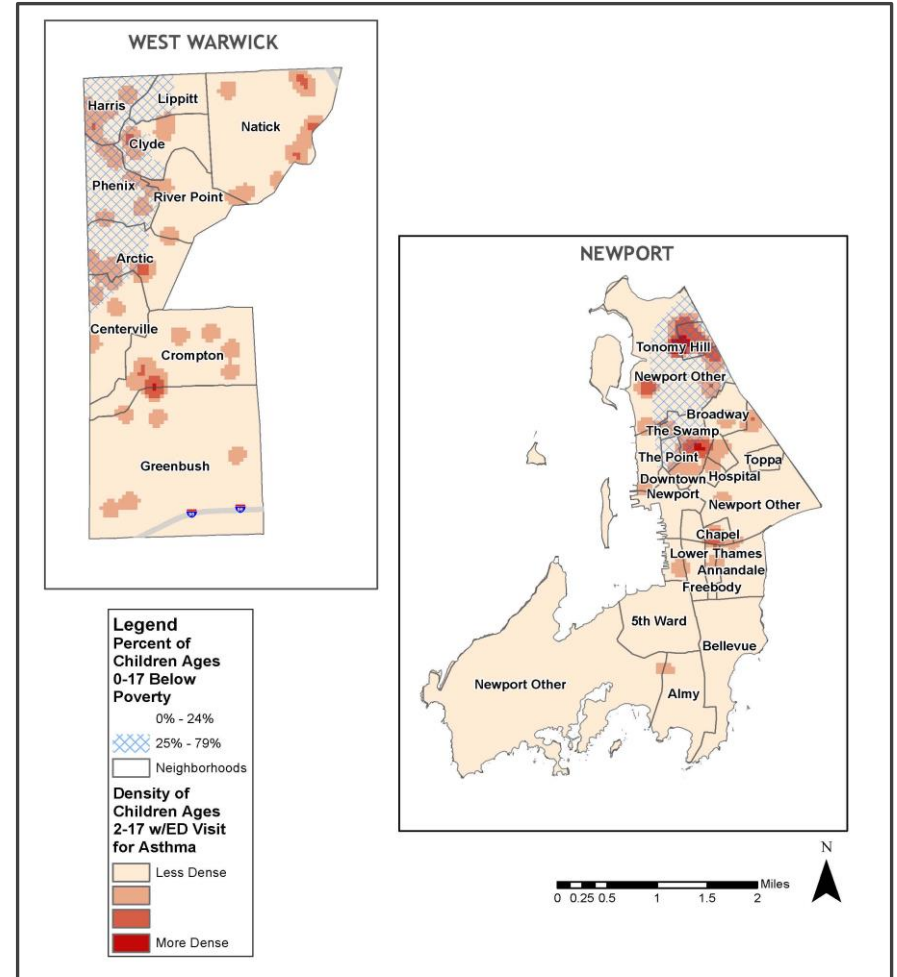
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
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Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 19

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012,
with Percent of Children Under 18 Living Below Poverty



* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

3

Asthma Claims Prevalence and Housing Factors

Asthma and Housing Factors

A child's physical surroundings have important implications for his or her health. Housing that is damp and poorly ventilated may encourage the growth of mold and mildew, pest infestations, and poor indoor air quality—known asthma triggers.

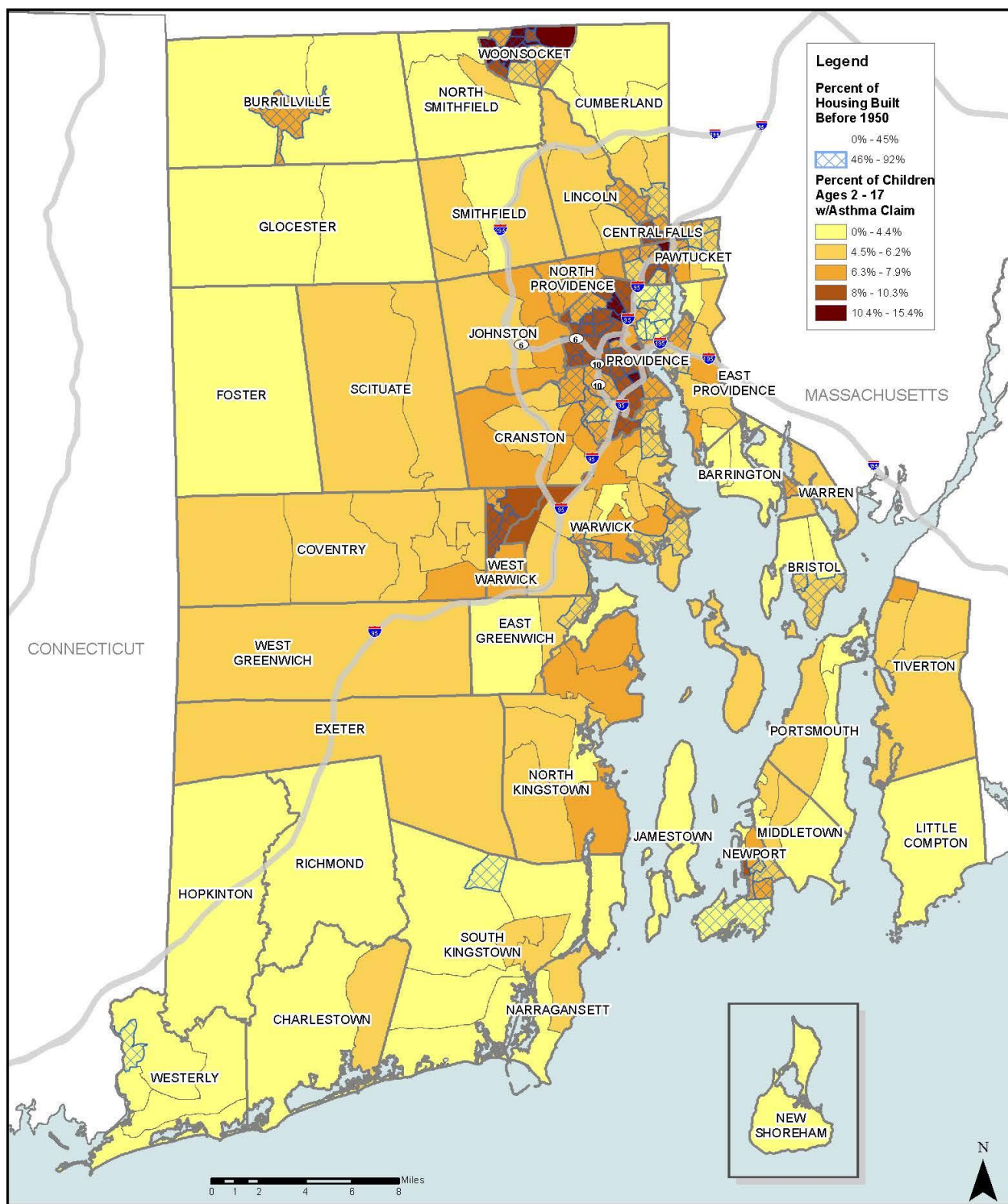
The percentage of housing units built before 1950 provides a rough proxy for the presence of asthma triggers that are associated with older housing. The limitation of this measure is that the age of housing is not the sole determinant of the presence of these triggers. An important factor that is not reflected in age of housing is the income of homeowners or home dwellers. Higher income homeowners or dwellers may have the resources to complete home improvements that enhance the healthiness of the home. This includes enhancement to home insulation, installation of air-tight storm windows, and improved home ventilation systems. The age of the house alone does not define the healthiness of the home. Appendix A.2 provides a closer look at the relationship between asthma claims prevalence and age of the housing stock.

Figures 20 and 21 overlay age of housing on asthma claims prevalence and emergency department utilization. The blue crosshatched areas represent census tracts where 46% or more of housing units were built before 1950. As the maps illustrate, there is wide coverage of older housing across the major urban areas of the state. At least 46% of the housing stock in each census tract in the city of Providence was built before 1950.

Another dimension of the relationship between asthma and housing is the proximity of asthma incidence to low-and-moderate-income housing. Low-and-moderate-income housing is defined as residential units that are supported by public housing subsidies and are intended to provide low-income families with affordable and safe housing options. One would expect low-and-moderate-income housing to be located in lower-income areas. Figures 22 through 25 demonstrate the proximity of low-and-moderate-income housing to areas with high numbers of children with an asthma claim. These figures overlay the locations of low-and-moderate-income housing on the asthma density maps from previous sections. These maps should not be construed as proving that children with asthma claims cluster in low-and-moderate-income units. Such an assessment would require more detailed address-level analysis.

Figure 20

Percent of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
Three-Year Average and Percent of Housing Built Before 1950



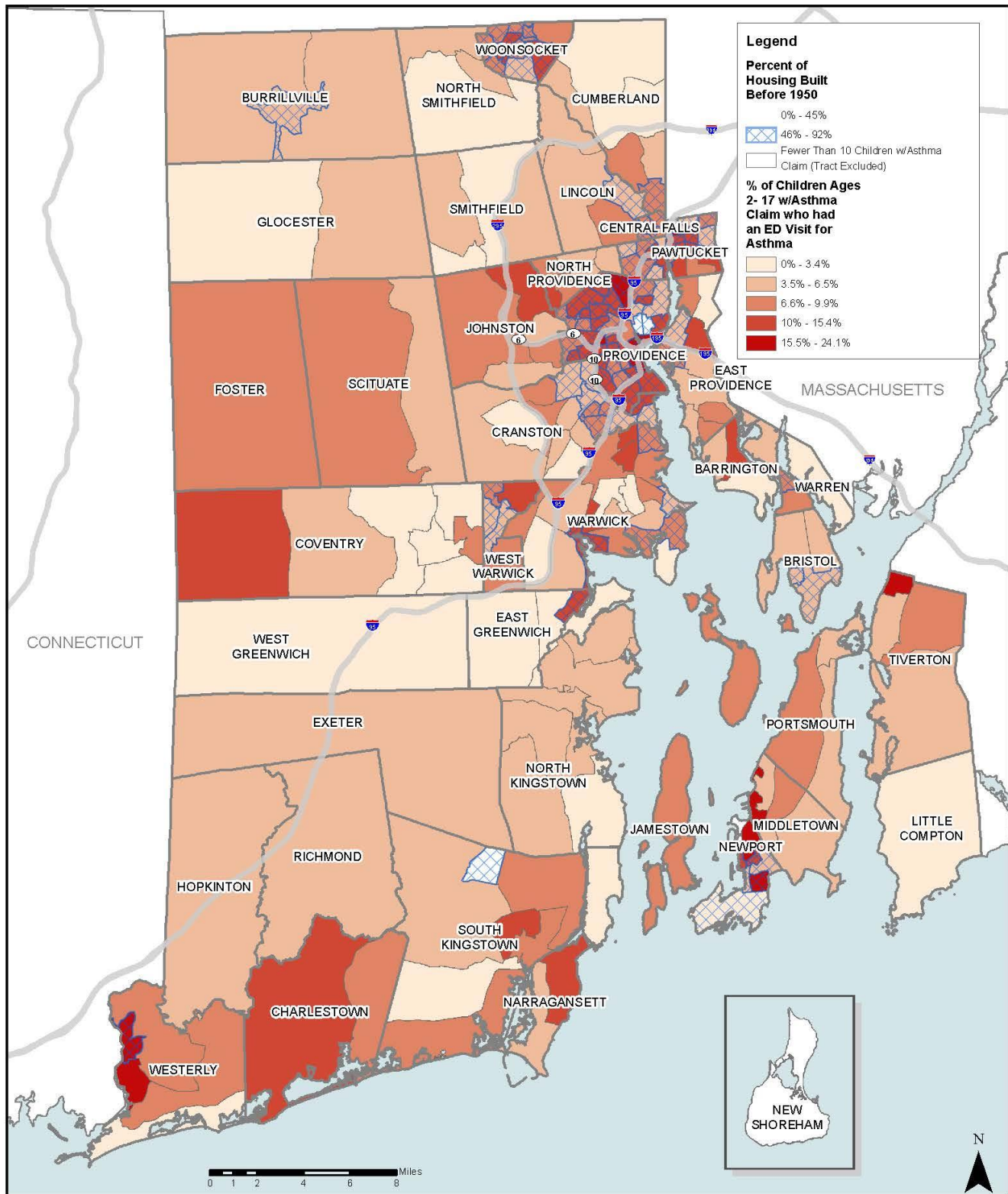
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 21

Percent of Children Ages 2-17 with an Asthma Claim* who had an Asthma Emergency Department Visit**, 2010-2012, with Percent of Housing Built Before 1950



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

** Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

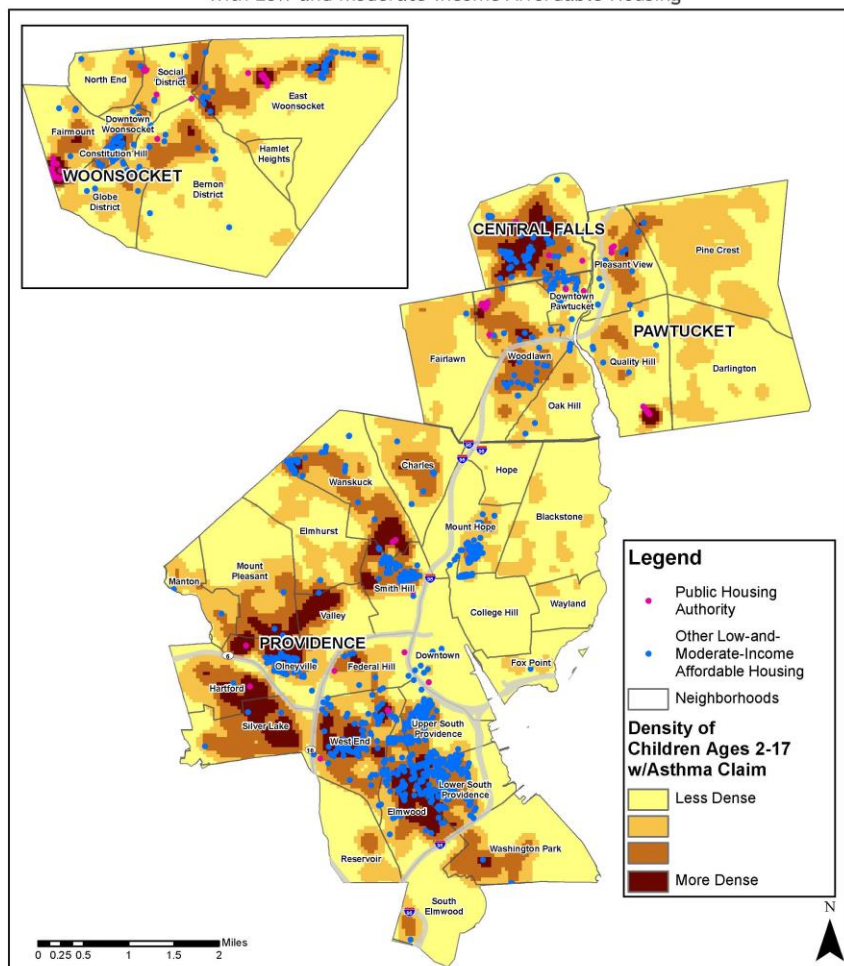
Rhode Island State Plane Feet, NAD83

Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 22

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
with Low-and-Moderate-Income Affordable Housing



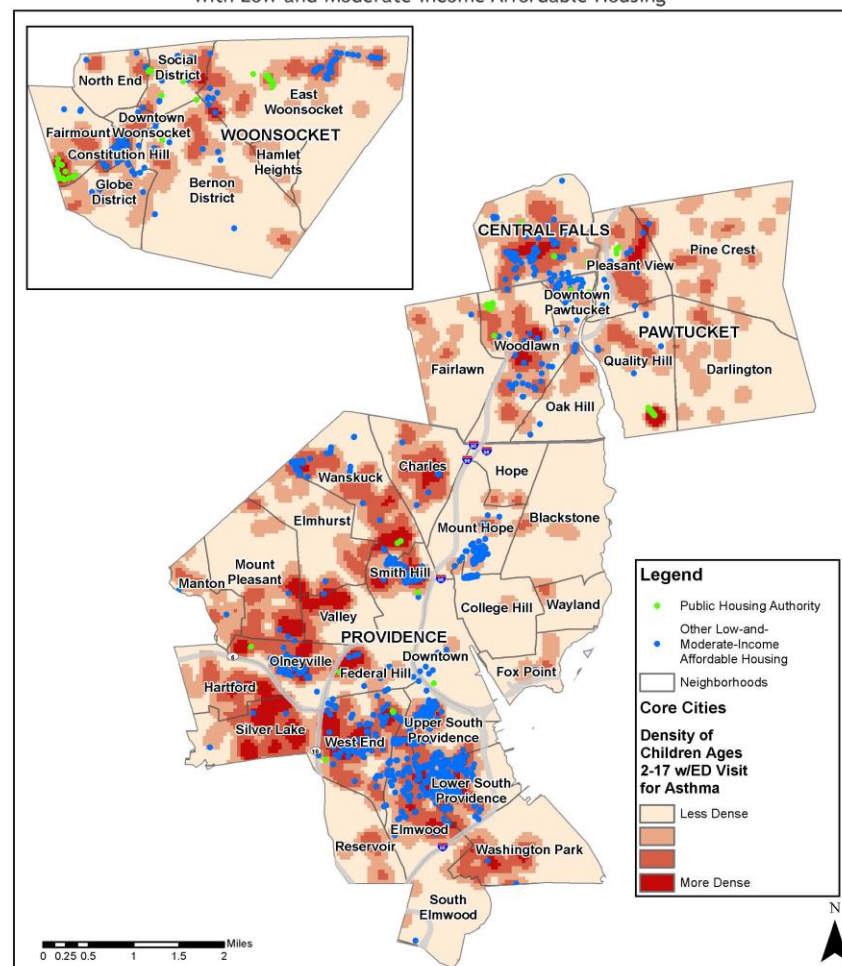
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health,
Rhode Island Housing

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 23

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012,
with Low-and-Moderate-Income Affordable Housing



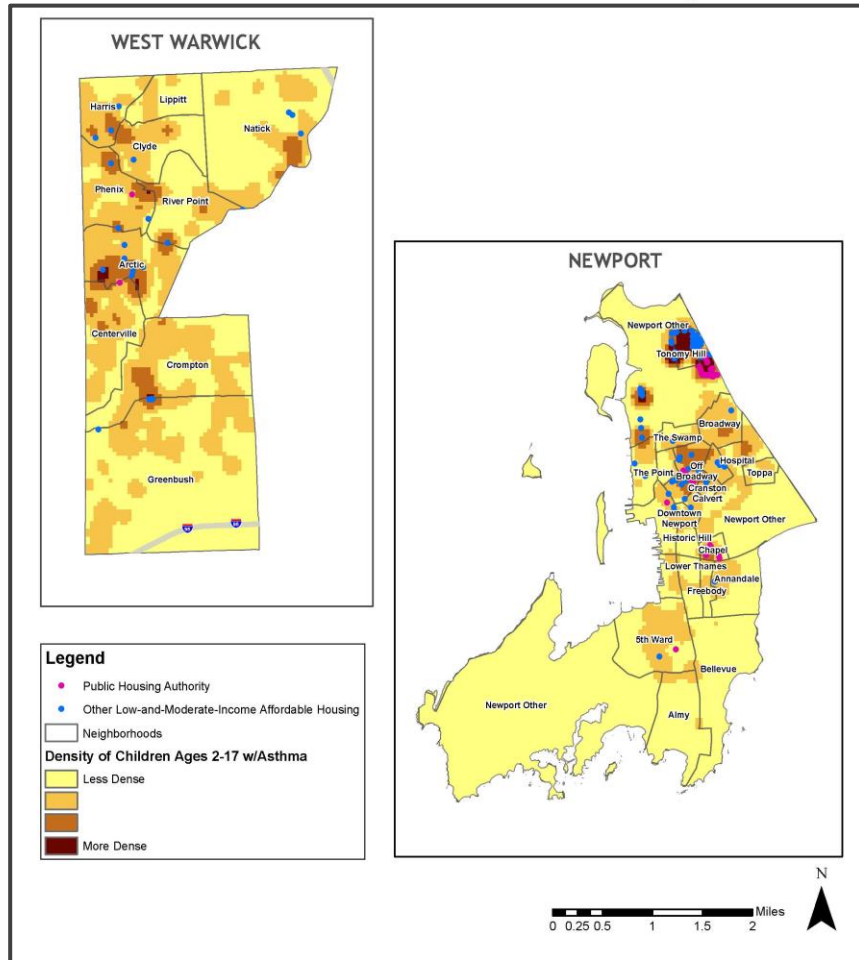
* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health,
Rhode Island Housing

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 24

Density of Children Ages 2-17 with an Asthma Claim*, 2010-2012,
with Low-and-Moderate-Income Affordable Housing



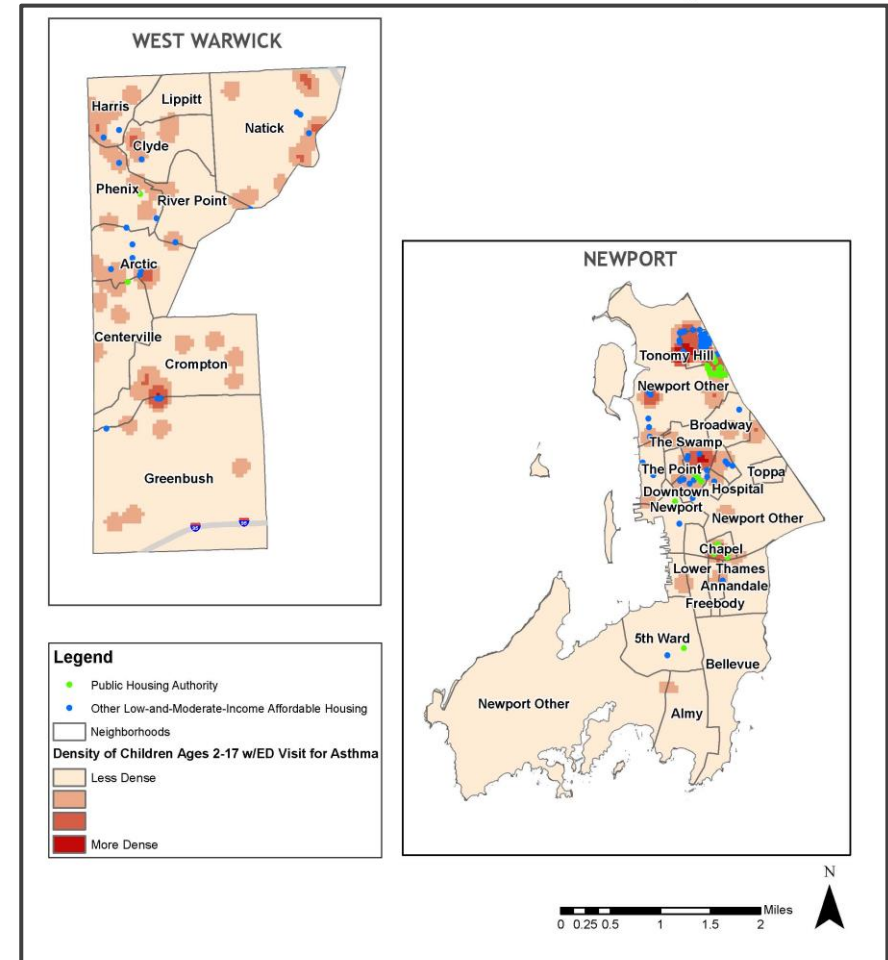
* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health,
Rhode Island Housing

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 25

Density of Children Ages 2-17 with an Asthma Emergency Department Visit*, 2010-2012,
with Low-and-Moderate-Income Affordable Housing



* Primary diagnosis of asthma on an Emergency Department claims form, ICD-9-CM 493.xx

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011),
Rhode Island Geographic Information System (RIGIS),
Neighborhood Health Plan of Rhode Island, United Healthcare of New England,
Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health,
Rhode Island Housing

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

4

Asthma and Chronic Absenteeism

Asthma and Chronic Absenteeism

For children, asthma can lead to missed school days, causing them to fall behind in their studies. If unabated, these issues can reduce a child's long-term economic and social wellbeing.

This section quantifies the educational consequences of childhood asthma by focusing on rates of chronic absenteeism from school, among children who have had an asthma claim between 2010 and 2012. Following Chang and Romero (2008), chronic absenteeism is defined as having missed 10% or more of total school days enrolled within a school year.¹

Chronic absenteeism was determined by linking the asthma data with Rhode Island Department of Education (RIDE) enrollment records. Children with asthma who were not enrolled in a public or charter school are not included in the chronic absenteeism maps that follow. Further details are provided in Appendix A.1.

There were 18,022 children identified with asthma who were enrolled in a public or charter school at some time between the 2009-10 and 2012-13 school years. Of those 18,022 students, 6,744, or 37.4%, were chronically absent in at least one of the school years.

Observing patterns of chronic absenteeism among children with asthma enhances our understanding of vulnerability. Family issues, transportation, poverty, and other health problems can affect a student's risk of missing school days. Areas with the highest rates of chronic absenteeism among children with asthma may reflect the existence of other disadvantages.

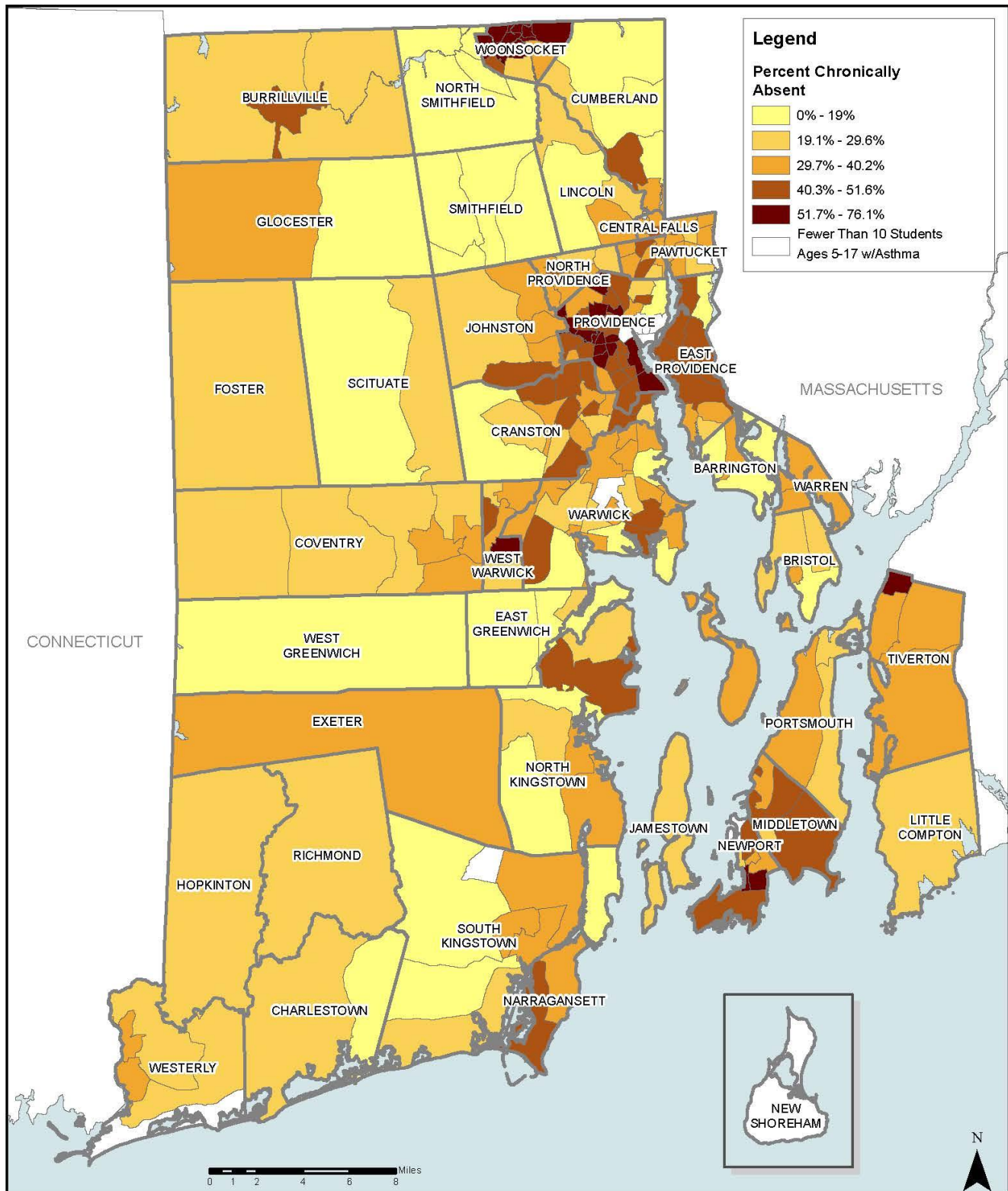
The following maps display the percentage of public and charter school students with an asthma claim who were chronically absent from school. Figure 26 shows the percent of chronically absent students for all Rhode Island census tracts. Figures 27 and 28 show the percent chronically absent by census tract for the core cites and Newport and West Warwick, respectively. Neighborhood boundaries are superimposed. Census tracts with fewer than 10 students with an asthma claim were not shown.

The highest rates of chronic absenteeism prevail in Providence, Woonsocket, and a handful of census tracts in Newport, West Warwick, and Tiverton.

¹ Chang Hedy N. and Mariajosé Romero. 2008. *Present, Engaged, and Accounted For: The Critical Importance of Addressing Chronic Absence in the Early Grades*. New York: National Center for Children in Poverty.

Figure 26

Percent of RIDE Students Ages 5-17 with an Asthma Claim* who were Chronically Absent from School (10% or more)**



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx in either 2010, 2011 or 2012.

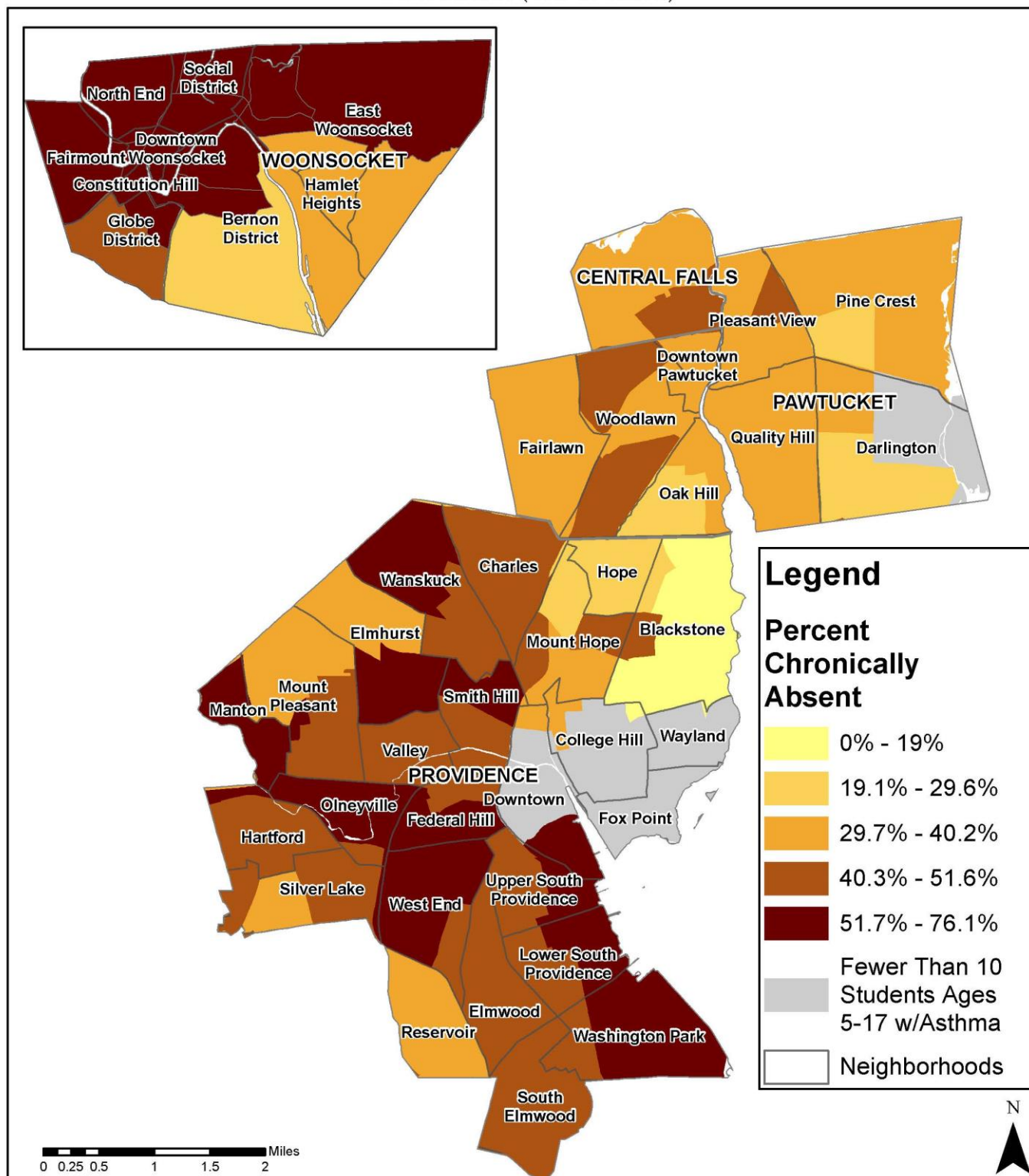
** Students 5-17 who were chronically absent in SY 2009-2010, 2010-2011, 2011-2012, or 2012-2013 in which the school year overlapped with the calendar year of the asthma claim.

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health
Rhode Island Department of Education Enrollment File

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 27

Percent of RIDE Students Ages 5-17 with an Asthma Claim* who were Chronically Absent from School (10% or more)**



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx in either 2010, 2011, or 2012.

** Students 5-17 who were chronically absent in SY 2009-2010, 2010-2011, 2011-2012, or 2012-2013 in which the school year overlapped with the calendar year of the asthma claim.

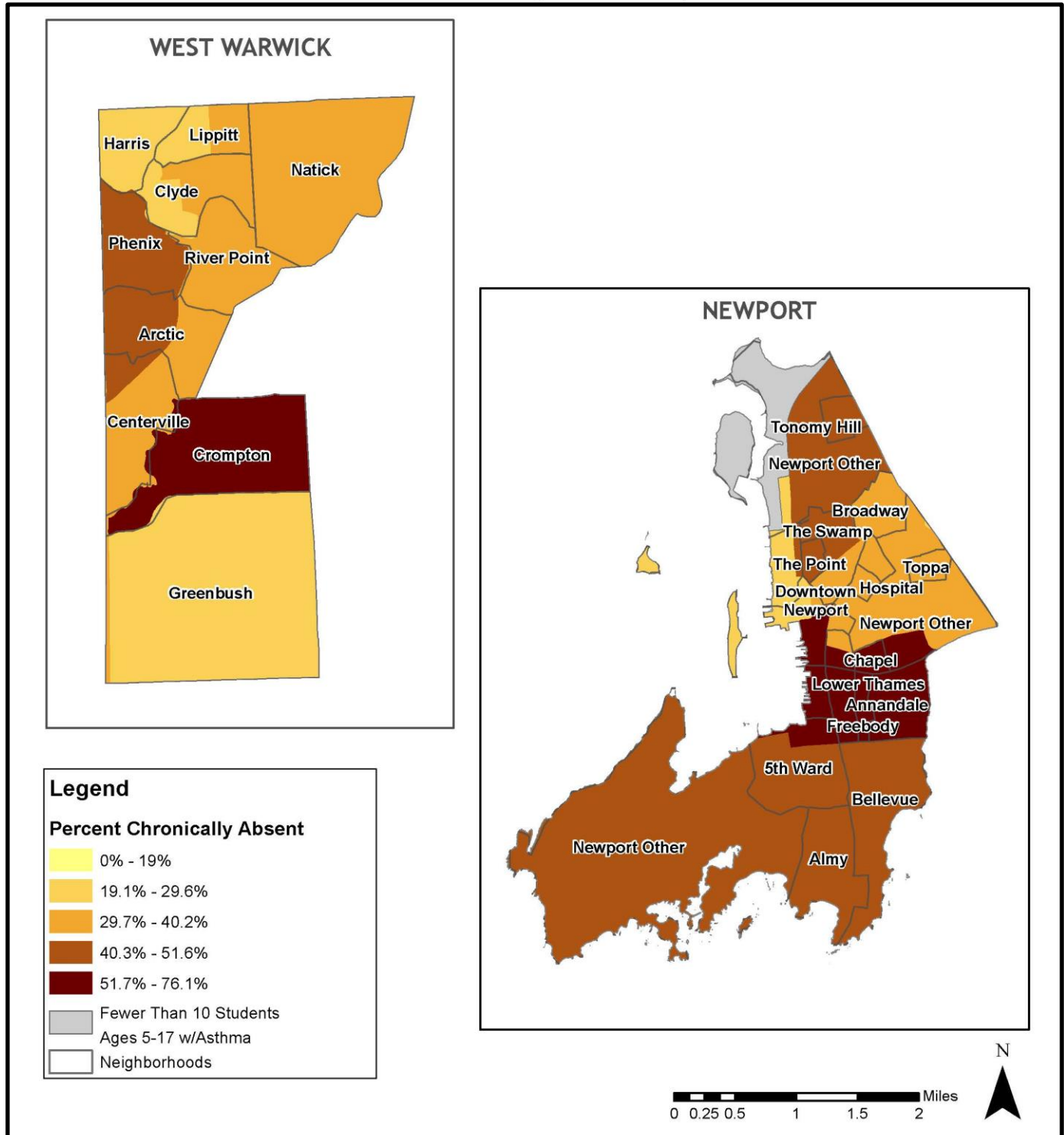
Rhode Island State Plane Feet, NAD83

Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health Rhode Island Department of Education Enrollment File

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Figure 28

Percent of RIDE Students Ages 5-17 with an Asthma Claim* who were Chronically Absent from School (10% or more)**



* Asthma diagnosis in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form, ICD-9-CM 493.xx in either 2010, 2011, or 2012.

** Students 5-17 who were chronically absent in SY 2009-2010, 2010-2011, 2011-2012, or 2012-2013 in which the school year overlapped with the calendar year of the asthma claim.

Rhode Island State Plane Feet, NAD83
Data Sources: Census 2010, American Community Survey 5-year (2007 - 2011), Rhode Island Geographic Information System (RIGIS), Neighborhood Health Plan of Rhode Island, United Healthcare of New England, Blue Cross & Blue Shield of Rhode Island, Rhode Island Department of Health
Rhode Island Department of Education Enrollment File

Map Produced by: The Providence Plan
For: Rhode Island Department of Health

Appendices

A.1: Technical Appendix

The Data

Blue Cross Blue Shield of Rhode Island (BCBSRI), Neighborhood Health Plan of Rhode Island (NHPRI), and United Healthcare of New England (UHC) submitted three years of asthma claims data for children between the ages of 2 and 17. Data were reported for children who sought care for asthma in one of three settings: physician office, emergency department, or hospital inpatient. Care for asthma was determined by the presence of an asthma diagnosis (ICD-9-CM 493.xx) in diagnosis fields 1-6 (UHC) or 1-4 (BCBSRI and NHPRI) on any claims form. The health plans also reported the number of emergency department visits and inpatient hospitalizations per child for which asthma was listed as the primary diagnosis on an emergency department or inpatient claims form. The claims data also included the number of months the child was enrolled with the health plan along with the child's address.

One of the limitations of this project is that we did not possess claims data for every child living in Rhode Island. The claims data do not include children who were uninsured or who were covered through some other policy or plan (e.g., some self-insured plans, Tufts Health Plan, etc.) during the study period 2010-2012. Inclusion methods varied between the three health plans. BCBSRI included self-insured and fully insured members. UHC included Medicaid and fully insured members. NHPRI included all Rite care, special needs and foster care members.

The pooled three years of claims data yielded information for 26,827 children whose primary state of residence was Rhode Island.

General Methods: How Asthma Claims Data Can Be Presented Geographically

Based on each child's name and date of birth, the asthma claims records were linked between years and health plans, when children changed insurer. The residential address associated with the health plan for which each child spent their maximum number of months enrolled was determined by year and for the full three-year period. These addresses were used to geocode cases and assign to each case the census tract identification number associated with their place of residence. Geocoding is a process by which cases are represented as points on a map based on address information. Geocoding yielded a 96.9% match rate for the three years of data. This means that 96.9% of the asthma cases could be represented as points on a map. The unmatched 3.1% could not be included in our analysis. Some cases did not match due to erroneous address information or when children's addresses were given as Post Office boxes.

Chronic Absenteeism

The asthma data were linked to Rhode Island Department of Education (RIDE) enrollment records. The RIDE enrollment files include information on students

enrolled in public schools—including charter schools. We used data from four school years: 2009-10 through 2012-13.

The file resulting from the linkage contained information for 18,022 children with an asthma claim who were enrolled in a Rhode Island public school in at least one of the four school years.

Within single school years, children who changed schools had their days of coverage by the health plan and days of attendance summed across all schools. These two fields were used to construct the percentage of school days missed for each student within each school year. Within school years, students were excluded if their total days of health plan coverage were less than 30.

Chronic absenteeism was defined as missing 10% or more of school days enrolled. Furthermore, for a child to be considered chronically absent, the school year of the chronic absence had to overlap with the calendar year of the asthma claim. This assignment method was used because the asthma data submitted by the insurers lacked dates of service. Therefore we were unable to pinpoint the exact school year of the asthma event.

Principal Limitations

Asthma prevalence in children is measured using survey data from the Behavioral Risk Factor Surveillance System (BRFSS). In 2012, 12% of Rhode Island children, based on parental reporting, had doctor-diagnosed current asthma (BRFSS 2012). Underlying statewide childhood asthma prevalence is variation in rates of childhood asthma across geographic areas. Ideally, asthma rates across small geographic areas would be measured and presented in a way that is consistent with the standard measurement of asthma prevalence based on the BRFSS. Unfortunately, that is not possible with claims data. The key difference between the BRFSS and the claims data is that BRFSS data are representative of all children living in Rhode Island, whereas the asthma claims data represent only children who were enrolled with one of the three insurers from which we acquired data. Specifically, the claims data limitations can be stated as follows:

1. Children not covered by one of the three Rhode Island insurers from which we acquired claims data are not included. The excluded population is comprised of children who are uninsured or who are covered by some other policy or plan; such as Tufts Health Plan, some self-insured plans, or health plans sponsored by entities outside of Rhode Island.
2. Within the claims data provided by the commercial health plans we lack data that are comprehensive of the privately insured population. Variations in the inclusions methods of the health plans occurred.
3. The data likely over represent children enrolled in Medicaid because claims data were collected from both Medicaid health plans but collection from the privately insured population was not as comprehensive. The overrepresentation of Medicaid enrollees in

the data likely bears consequences for geographic analysis due to low-income families concentrating in particular communities.

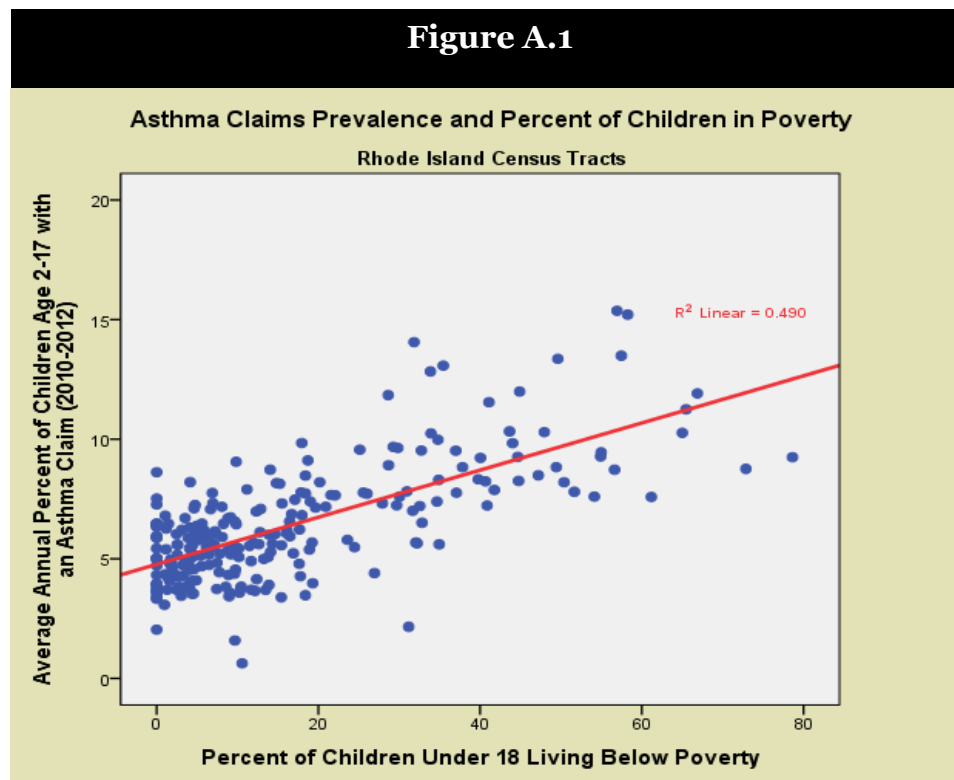
4. The data capture children whose asthma is severe enough to have led them to seek care in a physician office, emergency department, or hospital inpatient setting. Prescription drug claims are not included in the data. Children whose asthma is mild or controlled, and who have not incurred asthma claims between 2010 and 2012 do not show up in the claims data.

5. The data include paid claims only. Pending and denied claims are not included.

Due to these limitations, we rely on the term *claims prevalence*, to convey the fact that information is derived from claims data and presented for a subset of Rhode Island children. The data we present do not reflect true asthma prevalence.

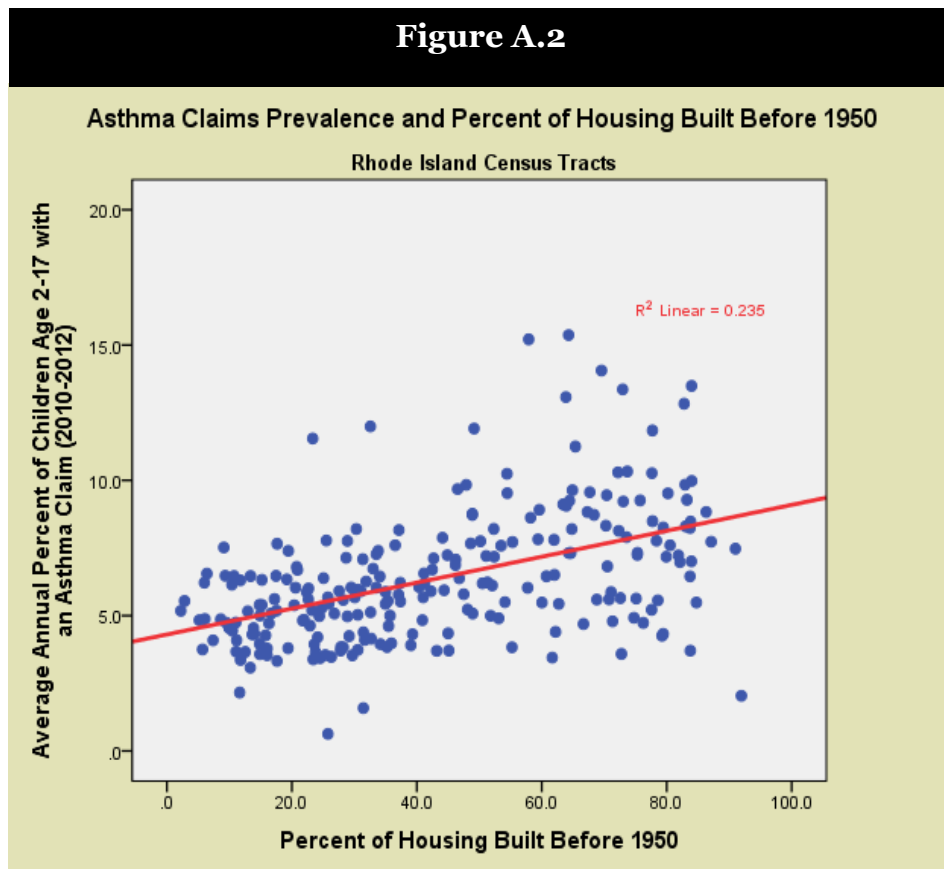
A.2: Supplemental Analyses

The Relationship between Asthma Claims Prevalence and Poverty: The relationship between asthma claims prevalence and the percent of children living below poverty is strong (Pearson Correlation Coefficient = 0.70). Figure A.1 provides a scatterplot of census tracts on two variables: asthma claims prevalence and poverty rates among children. The figure also displays a line of best fit from a simple linear regression of asthma claims prevalence on poverty. This regression treats asthma claims prevalence as a function of poverty rates among children. In other words, poverty is a determinant of asthma claims prevalence.



A strong positive association between asthma claims prevalence and poverty can be observed, with higher rates of claims prevalence occurring in census tracts with higher rates of children living below the poverty line. The gradient of the association, or the slope of the fitted line, should not be given a causal interpretation. This is due to the existence of other factors that are determinants of claims prevalence, but which are correlated with poverty, such as lacking resources for home improvements or maintenance, air quality, and environmental factors in residential areas. The R^2 tells us that 49% of the statistical variation in asthma claims prevalence is explained by variation in poverty rates among children.

The Relationship between Asthma Claims Prevalence and Age of Housing: The relationship between asthma claims prevalence and age of housing is fairly weak (Pearson Correlation Coefficient = 0.485). Figure A.2 provides a scatterplot of census tracts on asthma claims prevalence and the percent of housing built before 1950. The R^2 indicates that just 23.5% of the statistical variation in asthma claims prevalence at the census tract level is explained by variation in the percent of housing built before 1950.



Data Sources:

Blue Cross Blue Shield of Rhode Island

Neighborhood Health Plan of Rhode Island

Rhode Island Department of Education Enrollment Data

Rhode Island Housing Low Mod Chart Mapping File

United Healthcare of New England

U.S. Census Bureau; Census 2010, Summary File 1, Matrix P014 'Sex by Age for the Population Under 20 Years

U.S. Census Bureau; American Community Survey, 2007-2011 American Community Survey 5-Year Estimates, Table B17001 'Poverty Status in Past 12 Months by Sex by Age'

U.S. Census Bureau; American Community Survey, 2007-2011 American Community Survey 5-Year Estimates, Table B25034 'Year Structure Built'