



# **Healthy Housing: Why Rhode Island should invest in the vision**

January 2007

**Prepared by the Rhode Island Department of Health's  
Childhood Lead Poisoning Prevention Program  
in partnership with the  
HEALTHY HOUSING COLLABORATIVE**



## TABLE OF CONTENTS

<b>SECTION I. EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>SECTION II. THE VISION FOR HEALTHY HOUSING IN RHODE ISLAND .....</b>	<b>6</b>
<b>ASTHMA .....</b>	<b>7</b>
<i>Impact on health and development .....</i>	<i>7</i>
<i>What is asthma costing Rhode Island?.....</i>	<i>8</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>8</i>
<b>LEAD POISONING .....</b>	<b>10</b>
<i>Impact on health and development .....</i>	<i>10</i>
<i>What is lead poisoning costing Rhode Island?.....</i>	<i>11</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>11</i>
<b>PEST INFESTATION .....</b>	<b>14</b>
<i>Impact on health and development .....</i>	<i>14</i>
<i>What is pest infestation costing Rhode Island? .....</i>	<i>14</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>15</i>
<b>HOUSING INSTABILITY, HOMELESSNESS, AND FOOD AND ENERGY INSECURITY .....</b>	<b>16</b>
<i>Impact on health and development .....</i>	<i>16</i>
<i>What are housing instability and homelessness costing Rhode Island?.....</i>	<i>17</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>17</i>
<b>DISABILITIES AND HOUSING ACCESSIBILITY .....</b>	<b>19</b>
<i>Impact on health and development .....</i>	<i>19</i>
<i>What is the lack of accessibility costing Rhode Island?.....</i>	<i>19</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>20</i>
<b>INJURIES .....</b>	<b>21</b>
<i>Impact on health and development .....</i>	<i>21</i>
<i>What are injuries costing Rhode Island? .....</i>	<i>21</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>21</i>
<b>INDOOR AIR QUALITY.....</b>	<b>23</b>
<i>Impact on health and development .....</i>	<i>23</i>
<i>What is indoor air quality costing Rhode Island?.....</i>	<i>24</i>
<i>Effective Interventions: Evidence from local and national research. ....</i>	<i>27</i>
<b>NOISE.....</b>	<b>29</b>
<i>Impact on health and development .....</i>	<i>29</i>
<i>Effective Interventions: Evidence from local and national research .....</i>	<i>29</i>
<b>SECTION III. NEIGHBORHOOD LEVEL CONSIDERATIONS .....</b>	<b>31</b>
<b>SECTION IV. WHAT CAN WE DO TO ACHIEVE THIS VISION?.....</b>	<b>32</b>
<b>SECTION V. APPENDICES .....</b>	<b>38</b>
<b>SECTION VI. REFERENCES .....</b>	<b>64</b>

**SECTION VII. ENDNOTES.....68**

## **SECTION I. EXECUTIVE SUMMARY**

This document was developed by the Rhode Island Healthy Housing Collaborative, a statewide collaborative of agencies and individuals interested in coordinating current state and community resources allocated for healthy housing work. The Collaborative aims to advocate for programmatic and policy changes that will help to create a systematic approach to Healthy Housing issues in Rhode Island.

This document is a product of a Memorandum of Understanding between the Rhode Island Department of Health and the Rhode Island Housing Resources Commission between January 17<sup>th</sup>, 2006 and December 31<sup>st</sup>, 2006 (Appendix 4). This Memorandum allocated a portion of one staff person's time to act as a liaison between the two agencies and to produce the following deliverables:

- Develop a vision statement for “healthy housing” in Rhode Island with input from the Healthy Housing Collaborative;
- Conduct a thorough literature review, and prepare a report on:
  - The impacts of unhealthy housing on child health and development;
  - Benefits for child health and development associated with improved housing maintenance and building practices;
  - Cost-benefit analysis for healthy housing building and maintenance practices.
- Conduct an assessment of existing state resources (financial and staff) currently allocated to healthy housing;
- Conduct an assessment of major strategic plans in the state (Rhode Island's Plan to Eliminate Childhood lead Poisoning, Rhode Island's Plan to End Homelessness, Rhode Island's Five Year State Strategic Housing Plan, and the city and town affordable housing plans mandated by the Low and Moderate Income Housing Act) to identify overlapping goals and opportunities for partnership and collaboration.

The intent of this document is not to summarize the vast literature on environmental health issues such as asthma, lead poisoning, and injury. Rather, this document intends to provide a brief overview of the vast literature indicating the impact that unhealthy housing has on health outcomes to give Rhode Islanders a base of knowledge of why the state is working on these issues. A summary of these healthy impacts is included in the Healthy Housing Matrix in Appendix 1. Next, the document discusses interventions that have been both successful and unsuccessful in improving environmental health outcomes at the national and regional level. Additionally, the document discusses the costs and cost savings associated with these types of interventions.

The final section of this document discusses both short-term and long-term action steps that the Healthy Housing Collaborative feels are critical in efforts to create and maintain safe, healthy, and affordable housing in Rhode Island. Some of the recommended action steps will be accomplished between January 1, 2007 and December 31, 2007 through a revised Memorandum of Understanding between the Housing Resources Commission and the Rhode Island Department of Health (Appendix 5). The long-term and broader objectives will require collaboration among the members of the Healthy Housing Collaborative to design realistic action steps to achieve these goals.

The Healthy Housing Collaborative has agreed to the following guiding principles in the development of this document:

The vision statement and any action objectives related to the vision shall be:

- Achievable
- Realistic
- Flexible
- Challenging
- Appealing to diverse groups
- Inspiring
- Exciting
- Broad and far-reaching

To date, there is no internationally agreed upon definition of healthy housing. The National Center for Healthy Housing defines “healthy housing” as housing that is “designed, constructed, maintained, or rehabilitated in a manner that supports the health of residents.”<sup>1</sup> The World Health Organization states, “ ‘healthy housing’ covers the provision of functional and adequate physical social and mental conditions for health, safety, hygiene, comfort and privacy.”<sup>2</sup> However, international momentum to address the health impacts of unhealthy housing through housing policy is rising. At the Fourth Ministerial Conference on Environment and Health in Budapest, Hungary in June 2004, 250 decision makers and scientists from 24 countries agreed upon the following Declaration:

*“We are therefore committed, within the limits of our national mandates, to taking action to ensure that health and environmental dimensions are placed at the core of all housing policies (from housing construction and rehabilitation plans, programs and policies to the use of adequate building materials) and that healthy conditions are ensured and maintained in the existing housing stock. We commit ourselves to contributing to the development and strengthening of housing policies that address the specific needs of the poor and the disadvantaged, especially regarding children.”*<sup>3</sup>

The concept of “healthy housing” addresses both physical and structural housing issues as well as broader neighborhood and community factors. Researchers have referred to these as “hard” factors and “soft” factors, noting that both can have direct and indirect impact on the residents’ quality of life and health outcomes.<sup>4</sup>

Specific factors that need to be addressed when discussed “healthy housing” include:

- Structural stability;
- Heating and ventilation systems;
- Basic infrastructure systems, such as water and sanitation systems;
- Toxins, such as radon, lead, mold, pesticides, Volatile Organic Compounds (VOC’s) and carbon monoxide, that can be found in homes;
- Potential for injury or fire as a result of improperly maintained systems, such as electrical wiring and supplemental heating systems;
- Adequate space for all residents in a home;
- Physical accessibility of the unit;
- Neighborhood characteristics, such as violence, pollution, and noise;
- Location and availability of services, such as proximity to public transportation infrastructure, work, school, grocery stores or markets, and community services and community centers.

In Rhode Island, we are concerned that “unhealthy housing,” housing that does not support the health and well being of its occupants, is detrimental to Rhode Island at both the individual and population level. At the individual level, unhealthy housing can lead to poor health and economic outcomes for individuals such as:

- Asthma
- Lead poisoning
- Injuries and burns (falls, fires, poisonings, etc.)
- Respiratory infections
- Physical reactions to extreme heat and cold due (Instable utilities)
- Cancer (radon and neurotoxin exposures)
- Housing instability and homelessness
- Food insecurity
- Decreased intellectual capacity (IQ), fewer economic opportunities, and increased dependency costs as a result of lead exposure
- Poor birth outcomes, such as prematurity and low birth weight
- Aggressive, antisocial behaviors

At the population level, these poor health and economic outcomes impact the entire state of Rhode Island through:

- Increased health care costs to treat diseases attributable to unhealthy housing
- Poor school performance and missed school days among children
- Poor work performance and missed work days among adults
- Decreased IQ's at the population level due to lead exposure and increased Special Education costs
- Increased juvenile justice and correctional service costs
- Increased disability services and institutional costs
- Increased system dependency costs (TANF, WIC, Food Stamps, Housing Assistance, etc.)

The Healthy Housing Collaborative believes that “place,” which includes both household-level and community factors, is an important modifiable determinant of health and well being in our communities. This document focuses primarily on interventions at the individual household level to improve housing for residents. However, it is clear that household-level strategies must be coupled with aggressive, targeted, community-level interventions to improve neighborhoods across Rhode Island. It is our hope that this document will lay the groundwork for improved coordination at the statewide level to create and maintain healthy housing in all communities across our state.

## SECTION II. THE VISION FOR HEALTHY HOUSING IN RHODE ISLAND

All Rhode Islanders have a right to housing that supports their growth, development, and physical and mental health, and provides the opportunity to achieve a positive quality of life throughout the entire lifespan.

This includes, but is not limited to:

- **Housing that promotes good health outcomes** for individuals and families, particularly for vulnerable populations such as children, pregnant women, and the elderly and disabled. According to the Healthy Homes principles developed by the National Center for Healthy Housing, that is housing that is dry, clean, pest-free, ventilated, safe, without contaminants, and is maintained.
- **Housing that is affordable** for individuals and families, so that they have sufficient funds to support all other basic needs such as food, clothing, utilities, and others;
- **Housing that is secure and stable**, such that individuals and families do not suffer from unnecessary or unwanted mobility, or periods of homelessness or overcrowding;
- **Housing that is accessible** to individuals and families with diverse needs and physical disabilities;
- **Housing that is well-maintained** and promotes the health and well-being of its residents in a sustainable, long-term approach;
- **A housing market that allows for choice**, and provides options for a variety of individual and family housing needs.

## **ASTHMA**

### ***Impact on health and development***

Asthma is a lung disease that is characterized by airway constriction, chronic inflammation, and episodic wheezing and cough. Asthma is on the rise across the United States and in Rhode Island. From 1980 to 1995 the percentage of children in the United States with asthma doubled.<sup>5</sup> Oftentimes, asthma symptoms are caused by common asthma triggers such as pollens, molds, animal dander, cleaners and other household products, emotional stress, air pollution, combustion by-products, environmental tobacco smoke, and others. Many of these environmental triggers are found in the home environments where families spend the bulk of their time. It is known that dust mite exposure in the home can induce asthma in a previously healthy child.<sup>6</sup> Children with asthma who have a sensitivity to cockroaches and are exposed to them suffer from an elevated risk of hospitalization.<sup>7</sup> Polyvinyl chloride flooring and textile wall materials are associated with bronchial obstruction during the first 2 years of life.<sup>8</sup> Additionally, older carpeting that has not been properly cleaned and maintained has been found to create a reservoir for dust, allergens, and chemicals.<sup>9</sup> Identifying triggers can help individuals to control their asthma by controlling or minimizing exposure to these triggers.

Asthma is the number one chronic health condition of children in the United States, and is the leading cause of school absences resulting from chronic illness.<sup>10</sup> Using a group of children under the age of six with doctor-diagnosed asthma who had participated in the Third National Health and Nutrition Examination Survey, Lanphear et. al conducted a cross-sectional survey to identify residential risk factors for childhood asthma and quantify the relative contribution of these risk factors to asthma across the nation.<sup>11</sup> After controlling for potential confounding factors such as race, gender, and socioeconomic status, the use of a gas stove or oven for heat was found to be independently associated with doctor-diagnosed asthma. History of an allergy to a pet, presence of a dog in the house, and exposure to environmental tobacco smoke were also independently associated with doctor-diagnosed asthma. Using these independent associations, the researchers quantified the number of cases of doctor-diagnosed asthma in the study group that were attributable to residential exposures as 533,000 cases (39.2%). These cases were estimated to account for \$402 million annually in costs annually for diagnosing and treating asthma for children under the age of six.

While conventional combustion heating appliances are vented to the outside of housing to remove combustion products such as nitrogen dioxide, carbon monoxide, and carbon dioxide, cooking devices such as stoves and ovens are rarely vented to the outside of housing. Families who use their stove or oven to supplement their heating source may be emitting high levels of nitrogen dioxide and other asthma triggers into their homes. The independent association found between the use of a gas stove or oven for heat with doctor-diagnosed asthma in the NHANES III study is indicative of the critical relationship between rising housing and heating costs with environmental health issues such as asthma.

The Centers for Disease Control and Prevention utilized data from NHANES III to quantify the number of households using supplemental heating between 1988 and 1994. The data revealed that during this time, 13.7 million adults used an unvented space heater, that 9.3% of individuals with a gas stove used it for heating purposes, and that minorities and low-income families used space heaters more frequently.<sup>12</sup> In Rhode Island, there are currently no data to quantify how many families supplement their heating source with stoves or ovens. However, anecdotal evidence from the state's home visiting programs reveals that many Rhode Island families are struggling with rising heating costs, and that the use of stoves and ovens for heating is high among low-income families in Rhode Island. In designing an action plan to reduce childhood



asthma in Rhode Island, it is critical to consider policy and other interventions that will reduce the need for families to utilize supplemental heating sources.

### **What is asthma costing Rhode Island?**

Asthma rates have risen significantly over the last few decades. Across the nation, asthma prevalence in children ages 0-17 nearly doubled from 1980 to 1996, rising from 3.5% to 6.2%. The most recent data (2002) showed that 12.2% of children ages 0-17 had ever been diagnosed with asthma, 8.3% currently had asthma, and 5.8% had experienced an asthma attack in the previous year.<sup>13</sup> Over 160,000 children aged 0-14 years are hospitalized for asthma annually. Among all age groups, children aged 0-4 years had the highest hospitalization rate in 1993-1994 (49.7 hospitalizations per 10,000 persons). According to the 2002 Rhode Island Behavioral Risk Factor Surveillance System (RI BRFSS), one in ten Rhode Islanders currently have asthma, ranking Rhode Island as the state with the third highest asthma rate in the United States.<sup>14</sup>

Asthma disproportionately affects families of color and families living in poverty. Across the United States, children in families living below the poverty level are more likely to have ever been diagnosed with asthma than children in families that are not living below the poverty level (16% vs. 11%).<sup>15</sup> Families of color are disproportionately affected by asthma in Rhode Island, with one in eight African-Americans in Rhode Island currently suffering from asthma.<sup>16</sup> Additionally, children in the core cities of Rhode Island are nearly twice as likely to suffer from asthma than children living not living in one of Rhode Island's six core cities.<sup>17</sup>

Asthma results in higher annual disability claims for employees. Across the nation, per capita disability claims of employees with asthma are three times higher than those employees with no record of asthma treatment (\$14,827 vs. \$5,280).<sup>18</sup> Additionally, asthma results in 15 million missed workdays every year in the United States, resulting in nearly \$3 billion in lost productivity.<sup>19</sup>

### **Effective Interventions: Evidence from local and national research**

Published housing interventions for asthma generally include one or a combination of the following methods: educational home visits from nurses and community health workers; in-home environmental assessments; provision of mattress covers and other bedding encasements; provision of cleaning equipment such as HEPA vacuums; hot washing of bedding; provision of cockroach bait; and professional home extermination. As half of asthmatics have multiple sensitivities, interventions need to address multiple triggers and take place over longer periods of time to effectively control symptoms.<sup>20</sup> Studies suggest that intensive interventions to reduce the source of indoor allergens are necessary to truly control exposures. Sandel et al.'s review of housing interventions for children with asthma found that studies that utilized only one method, such as mattress or pillow covers, found little improvement in clinical outcomes for children with asthma. Those studies that utilized intensive interventions such as carpet removal and bedding replacement were most effective.<sup>21</sup>

Research has shown that modifications to the home environment in the first year of life can significantly decrease an infant's chances of developing asthma and can prevent asthma from progressing more rapidly or severely.<sup>22</sup> A Canadian study compared a cohort of infants at high-risk for the development of asthma who received home visiting and environmental intervention education with a control group who did not receive specific intervention education. At two years of age, 16.3% of the intervention children were classified as asthmatic, compared with 23% of the children in the control group. Moreover, children in the intervention group were

significantly less likely to be classified as having persistent asthma (defined as meeting criteria for asthma at both 12 and 24 months of age). In the intervention group, 4.9% of children had persistent asthma, as compared to 11.3% of children in the control group.

Few studies have approximated an exact cost for asthma interventions. A study of 937 inner city children with moderate asthma in seven U.S. cities tested the effectiveness of education and allergen and tobacco smoke remediation in the homes of exposed children. Home environmental exposures were assessed every six months, and asthma-related complications were assessed every two months during the intervention and for one year after the intervention. For every 2-week period, the intervention group had fewer days with symptoms than did the control group both during the intervention year (3.39 vs. 4.20 days) and the year afterward (2.62 vs. 3.21 days), as well as greater declines in the levels of allergens in the bed and on the bedroom floor. Decreases in cockroach allergen levels and dust-mite allergen levels on the bedroom floor were significantly correlated with reduced complications of asthma. On average, the intervention resulted in an increase of 37.8 symptom free days per child, improving quality of life, decreasing school absences, and decreasing missed workdays for caretakers. The cost of the intervention was estimated to be in the range of range of \$1,500 to \$2,000 per child, or approximately \$750 to \$1,000 for each year of the study. These costs include both personnel and equipment. The benefit of the intervention was apparent during both the treatment year and the year thereafter. If the duration of benefit were assumed to be even longer, the cost per year of benefit would be even lower. However, it should be noted that the intervention was tailored for each child, so although the benefits for the individual child were desirable, the effort was immense.<sup>23</sup> Visits from community health workers were successful, but the families who reported the best outcomes had adhered to the stringent cleaning routine that many of these interventions required. It is clear that the higher intensity and costlier interventions are the single most effective way to decrease the child's exposure to indoor allergens. However, considering the existing home visiting environment in Rhode Island, the personnel infrastructure for interventions such as these may exist at a much more cost effective rate in the state.

## **LEAD POISONING**

### ***Impact on health and development***

Substantial progress has been made in recent decades to reduce blood lead levels in children in the United States. This progress has come in part from the virtual elimination of lead from gasoline, as well as the prohibition of lead-based paint in 1978 by the Consumer Products Safety Commission. Additionally, lead levels in food and water have declined significantly as a result of decreased use of lead solder in cans and water pipe lines.<sup>24</sup> Despite these decreases in lead in the environment and the substantial decreases in the number of poisoned children, lead poisoning remains an environmental health risk for many children in the United States. The CDC has estimated that 83% of houses built before 1978 still have potential lead hazards that could poison children living inside of them.<sup>25</sup> Moreover, because lead does not biodegrade or decay, leaded soil provides a potentially long-term exposure to toxins for generations of our nation's children.

The effects of lead poisoning vary according to the level of exposure that a child experiences. Extremely high lead exposure (blood lead levels greater than 380 mcg/dL) can cause coma, convulsions, and even death in young children.<sup>26</sup> At moderate to high levels (above 20 mcg/dL), lead poisoning can cause adverse effects on different systems of the body including the central nervous system, the kidneys, and the hematopoietic system. At lower levels of lead poisoning (above 10 mcg/dL), children may experience decreased intelligence and impaired neurobehavioral development without showing distinctive symptoms.<sup>27</sup>

Lead poisoning has also been shown to affect the stature and growth of young children. Data from NHANES II reveals significant inverse relationships between blood lead levels and height, weight, and chest circumference in young children.<sup>28</sup> Prenatal lead exposure can also play a role in stunted growth. Shukla et al. (1989) highlighted the importance of both prenatal and postnatal lead exposure. The researchers followed a cohort of 260 infants in Cincinnati, Ohio, assessing prenatal lead exposure and infant blood lead and stature measurements every 3 months until 15 months of age. Their research added to the evidence that fetal lead exposure is negatively correlated with an infant's physical size. Even when controlling for obstetrical history, maternal medical history, alcohol and drug intake, smoking, and SES, infants exposed to lead in utero had smaller physical size when lead exposure continued postnatally.<sup>29</sup>

Another adverse effect of lead poisoning is decreased hearing acuity. Data from NHANES II demonstrates the subtle lead-related hearing loss that can occur in childhood. In general, this hearing loss appears to be undetected in early childhood and ultimately can result in learning disabilities that do not become apparent until the child is enrolled in school.<sup>30</sup> Other effects of lead poisoning include hyperactivity, as chelation therapy to remove lead from children's blood has been demonstrated to reduce hyperactivity in many children.<sup>31</sup>

Perhaps the most pervasive affect of lead poisoning in children, particularly at lower levels of exposure, is the decrease in IQ level and cognitive function. Lead damages the developing central nervous system, causing neurotoxic effects. A number of studies have repeatedly demonstrated the relationship between elevated blood levels and decreases in cognitive function. For example, Bellinger et al. (1991) demonstrated that higher blood lead levels at 24 months were associated with lower scores on the McCarthy Scales of Children's Abilities at age 57 months among a cohort of 170 middle and upper middle class children.<sup>32</sup> Regardless of socioeconomic status, higher postnatal exposure to lead was associated with poorer performance at age 57 months. Needleman and Gatsonis (1990) identified 24 studies on the association between childhood exposure to lead and IQ level in order to compare the overall

generalizability of the studies. Their quantitative review strongly supported the hypothesis that lead impairs children's IQ at low doses.<sup>33</sup>

The after-effects of lead poisoning have dramatic impacts throughout the lifespan. Neurological impacts are irreversible, ultimately impacting a child's ability to learn and the relative economic success that a lead poisoned child will have later in life. Additionally, a recent analysis of data from the third National Health and Nutrition Examination Survey (NHANES III) revealed that blood lead levels as low as 5-9 mcg/dL are associated with an increased risk of death from cardiovascular disease, cancer, and all other causes compared to individuals who had blood lead levels below 5 mcg/dL.<sup>34</sup> Lead has also been directly associated with delinquent and criminal behavior in a number of studies, including one cohort of 195 inner-city youth where a linear relationship was discovered between blood lead levels and the number of delinquent acts committed by the youth.<sup>35</sup>

### **What is lead poisoning costing Rhode Island?**

The Rhode Island Childhood Lead Poisoning Prevention Program tracks and reports the number of new cases of lead poisoning (defined as having a blood lead level greater than or equal to 10 mcg/dL) among children under the age of six who have never been previously poisoned. The proportion of new cases of lead poisoning has declined substantially in Rhode Island, from 14.7% in 1995 to 2.0% in 2005. Despite this progress, 621 children were poisoned for the first time in 2005.<sup>36</sup> These new cases continue to be concentrated in Rhode Island's core cities – cities where the child poverty level is greater than 15% (according to the 2000 Census). In 2005, the incidence of lead poisoning in the six core cities was more than four times that of the remaining 33 cities and towns (3.4% vs. 0.7%).<sup>37</sup> Moreover, the prevalence of elevated blood levels in poor children is disproportionately high. One in six low-income children living in older unassisted housing is believed to be lead poisoned.<sup>38</sup> A recent national survey concluded that children with elevated blood lead levels were most likely to live in a house built before 1960, a rental home and in the Northeastern United States.<sup>39</sup>

In Rhode Island, high rates of lead poisoning have resulted in unnecessary medical costs and other secondary costs such as lost future earnings and special education costs. From 2000 to 2004, the cost for medical treatment alone of children with elevated blood lead levels totaled \$1,294,784.<sup>40</sup>

In addition to direct medical costs, it is estimated in Rhode Island that:

- The state will spend \$756,340 to provide special education for the children newly poisoned in 2004 who suffered severe cognitive impairment as a result of their lead poisoning.<sup>41</sup>
- Rhode Island could have saved \$100,000 in juvenile justice expenditures if no children had been lead poisoned in 2004.<sup>42</sup>
- The 1,167 children who were newly lead poisoned in 2004 will have a totaled lost earnings of \$52,094,880 over their lifetime as a result of lost earnings from decreased IQ points.<sup>43</sup>

### **Effective Interventions: Evidence from local and national research**

The single most effective primary prevention effort for lead poisoning is in the form of housing interventions that remove all lead-based paint hazards from a home to ensure that further exposure is prevented. Abatement of such exposures can be extremely expensive depending on

the extent of the problem. Inexpensive housing interventions such as cleaning of floors and walls with lead-specific detergent and painting of window sills and other friction surfaces lessen the risk of lead exposure from six months to a year. Such interventions require interim monitoring in order to maintain the effectiveness. Nevertheless, inexpensive housing measures are only temporary solutions and do not eliminate the problem. According to a recent U.S. Department of Housing and Urban Development (HUD) survey, 38 million homes have lead-based paint, and 20 million homes have lead-based paint both on interior and exterior surfaces.<sup>44</sup> In Rhode Island, it is estimated that 30,000 units<sup>45</sup> throughout the state are considered high risk and in urgent need of lead hazard reduction.

Housing interventions described in the literature over the past ten years have shown moderate success. In this review, housing interventions are defined as efforts to improve housing conditions by cleaning, repainting peeling paint, soil abatement outside the home or full interior and exterior abatement. Many of the studies reviewed describe intervention efforts that are simply interim lead dust control measures.

There are several limitations of the studies reviewed. One limitation is the fact that only a few are large enough to provide substantial evidence of one intervention's effectiveness over another. In addition, few document the long-term effectiveness of the interventions, which is important because lead poisoning has known seasonal variations and must be followed up for at least one year. Furthermore, many of the studies include children who already have elevated blood lead levels, so for ethical reasons they automatically had to be assigned to the experimental group, which could bias the study results.

Few published studies provide the actual cost associated with housing interventions for lead dust exposure. One study of 213 urban children with moderately elevated blood lead levels provided for a single professional cleaning of the homes of the affected children. Lead dust samples were taken before and after cleaning. The estimated cost of labor and materials was detailed for each study site and was \$340 per home in Cincinnati, \$675 in Baltimore, \$291 in Newark, and \$1,140 in Philadelphia.<sup>46</sup> Following cleaning, floor dust lead loadings were reduced on average 32%, 66% for windowsills, and 93% for window wells. Although these were significant decreases in lead dust loadings, the one-time cleaning did not reduce the lead loadings of all dust samples to levels below current federal standards for lead in residential dust.

From 1994 to 1999 the US Department of Housing and Urban Development evaluated the intervention experiences of 2800 homes in 11 states in the United States that were involved with the Lead-Based Paint Hazard Control Grant Program. Different levels of intervention were categorized, ranging from cleaning/spot repair to full abatement. The research suggested that "a whole-building approach to lead-hazard control is most appropriate." Researchers found that performing some level of lead hazard control on all areas of the building was more beneficial than full abatement in only one or two areas, such as windows.<sup>47</sup>

Another study that mentioned specific costs was carried out in 37 children residing in Milwaukee with initial blood lead levels of 25 mcg/dL. The intervention included wet scraping and repainting deteriorated surfaces and wrapping window wells with aluminum or vinyl. It was estimated to cost \$2,370 per home (in 1994). After the intervention, there were statistically significant declines in children's blood lead levels, with the mean decline equal to 22%, one to six months after treatment.

It has been estimated that the first-year cost of reducing lead hazards in federally owned and federally assisted housing would be \$458 million. However, this in turn would save \$1.538

billion in medical and special education expenses, when taking into account the current and future residents of rental units.<sup>48</sup> Moreover, the costs associated with full lead abatement have been steadily decreasing over the past ten years, as contractors find more efficient and cost-effective remediation methods.<sup>49</sup>

Data from Rhode Island indicate limits of programs that intervene after children are lead poisoned. A study by Mary Jean Brown et al. compared the effectiveness of intensive home visiting educational programs and environmental sampling (dust and soil) for families of children with venous blood lead levels between 15 and 19 mcg/dL compared to programs with less intensive home visiting and no sampling. While the study found that parents significantly reduced dust lead levels in their homes, there was no evidence that more intensive programs resulted in a significant reduction of blood lead levels in children with moderate lead poisoning compared to children who did not receive intensive services. This study highlights the need for primary prevention of lead poisoning.<sup>50</sup>

## **PEST INFESTATION**

### ***Impact on health and development***

Both the existence of pest problems and the human response to these problems can put the health of individuals and children at risk. Urban communities across the country have experienced a resurgence of rodent problems in recent decades. Rodents and other pests can carry a number of diseases that threaten human health. Cockroaches are a well-documented asthma trigger. Furthermore, in attempting to deal with rodents and other pests many families ultimately put their health at risk through the use of toxic products to rid their homes of infestation. Many household products are highly toxic and can trigger asthma symptoms and asthma attacks. Accidental poisonings caused by common household problems can cause serious injury and death. Across the United States, poison control centers reported 113,000 cases of pesticide poisonings in 2003 alone.<sup>51</sup>

Rodents are associated with chronic respiratory infections, Hantavirus, salmonella, and the plague. The Centers for Disease Control and Prevention (CDC) have also found rodents to be a cause of lymphocytic choriomeningitis virus (LCMV) infection in humans.<sup>52</sup> LCMV infection is particularly harmful for pregnant women, fetuses, and immunocompromised individuals. LCMV infection during pregnancy is associated with spontaneous abortion, mental retardation, hydrocephalus, and microcephaly. Both wild and pet rodents have been found to have LCMV. The virus is spread either through the air or by human contact with body fluids from an infected rodent.

The CDC estimates that rats and mice bite 10,000 people a year across the United States, mostly children and the elderly.<sup>53</sup> A Philadelphia study of 622 rat bites discovered that the majority of rat bites occur in the bedroom, occur while victims are sleeping, and occur most frequently among children under one year of age.<sup>54</sup> Additionally, rodents can cause significant damage to physical structures and buildings. Rats and mice have started fires by gnawing on electrical wiring in buildings, resulting in injury and death.<sup>55</sup>

The use of pesticides in the home can have significant health consequences. Eighty percent of human exposure to pesticides in the U.S. occurs indoors.<sup>56</sup> Exposure to pesticides have been linked to learning, developmental, and behavioral problems<sup>57</sup> as well as to immune system problems.<sup>58</sup> A Manhattan study revealed that out of a sample of 316 women of color, 85% reported using pest control measures in their home during pregnancy.<sup>59</sup> Additionally, 35% of women reported that an exterminator had sprayed their homes during their pregnancy. All women had detectable levels of insecticides and pesticides inside their homes. Another recent study showed that women who were exposed to pesticides through agricultural work gave birth to children who had neurodevelopmental effects and abnormal reflexes as newborns.<sup>60</sup>

### ***What is pest infestation costing Rhode Island?***

In Rhode Island high resident turnover and vacant lots that provide food and shelter for rodents have undoubtedly contributed to a persistent rodent problem in the state. Providence's Department of Public Works has been attempting to combat this problem in key neighborhoods such as Olneyville, Silver Lake, and South Providence through pilot programs that provide "rat proof" trash bins and utilizing city workers to help bait rats in certain areas.<sup>61</sup>

Pest infestation can have an economic impact on families as well, resulting in wasted food that must be discarded due to contamination. As pest infestations are more likely to occur in homes

that are poorly maintained, this economic burden is disproportionately affecting lower income families that are living in poorly maintained housing.

**Effective Interventions: Evidence from local and national research**

The CDC has shown that a coordinated approach to integrated pest management at the community level can be successful. From 1972 to 1981 the CDC funded the federal urban rat control program, awarding grants to more than 65 cities and counties across the United States. The programs focused on health education, community sanitation, code enforcement, and some use of poisoning to control rodent populations. These programs resulted in significant environmental improvement of over 80 thousand blocks across the country.<sup>62</sup> However, these programs must be upheld to maintain and continue to improve the gains made. With increasing cuts to federal and state housing and waste management programs, the gains made through the CDC program seem to have disappeared, and rodent programs are resurging across the country.

In the absence of funding for large federal or state programs for pest control, there are a number of effective interventions that families can undertake to keep pests out of their homes. Integrated Pest Management focuses on reducing the amount of pesticides used while also reducing the number of pests within a home environment. IPM works to get rid of pests in the long-term by removing food and shelter from the pests. IPM strategies focus on three main strategies:

- Keeping pests out by blocking entries around the foundation of homes;
- Reducing the availability of food and water sources;
- Knocking down populations through traps and appropriate use of low toxicity pesticides.

By permanently eliminating entry sites for pests, maintaining a clean environment, and using low toxicity products, IPM is a low-cost, effective means to reduce families' exposure to harmful pesticides and to avoid poor health outcomes as a result of contact with rodents, cockroaches, and other pests.



## HOUSING INSTABILITY, HOMELESSNESS, AND FOOD AND ENERGY INSECURITY

### Impact on health and development

Housing instability and homelessness have significant effects on the physical and mental health of families. Homeless families consistently rate the health of their children as worse than the health of children in housed families. Moreover, individuals who suffered from housing stability or homelessness in childhood have been found to have 25% greater risk of having poor health and/or disabilities in adulthood, as well as a higher mortality rate than those who did not suffer from housing instabilities in childhood.<sup>63</sup> <sup>64</sup> Homeless families and families living in substandard housing have increased exposure to cockroach and rodent infestations, inadequate heat, and mold, all of which can trigger asthma attacks and symptoms.<sup>65</sup>

Researchers in Worcester, Massachusetts compared the health of 293 homeless children with 223 low-income children who had never been homeless. The study found that the homeless children had double the risk of visiting the emergency room twice or more in a year, and were significantly more likely to be hospitalized than the housed comparison group.<sup>66</sup> Numerous studies have confirmed these results: homeless children are much less likely to receive basic primary care services such as immunizations and lead screenings, and they suffer from more respiratory, ear and other infections that can lead to hearing problems and speech delays.<sup>67</sup> <sup>68</sup> <sup>69</sup> Finally, homeless children are more likely to experience hunger or food insecurity than children who are housed.<sup>70</sup> Food insecurity is when a household has limited or uncertain availability of food and limited or uncertain ability to acquire acceptable foods.<sup>71</sup> Malnutrition can have significant effects on children's growth, cognitive development, and behavioral development. Housing instability and homelessness also result in significant impacts on educational outcomes for children. Unstable housing conditions have been correlated with increased numbers of missed school days<sup>72</sup>, increased risk of repeating a grade<sup>73</sup>, and increased need for special education<sup>74</sup>.

The Child Health Impact Working Group in Boston, Massachusetts poignantly describes the trade offs that families experiencing housing instability must make. The researchers describe the "heat or eat" and "rent or eat" choices that families must make when their income is too low to afford all basic necessities.<sup>75</sup> Data from Boston Medical Center revealed that growth rates decreased for children between 6 months and 2 years of age during winter months, reflecting the tradeoffs between utility costs and adequate nutrition.<sup>76</sup> Another study revealed that children in families receiving rent subsidies were significantly less likely to have growth impairment related to undernutrition compare to children whose families were not receiving assistance in paying their rent.<sup>77</sup> In addition to poor or stunted growth, undernutrition and food insecurity are linked to increased rates of hospitalizations<sup>78</sup>, impaired cognitive and behavioral development<sup>79</sup>, and increased risk of overall poor health<sup>80</sup>.

**"An inadequate food supply prevents children from fully recovering from weight loss or interrupted growth during illness episodes, leading to poor nutritional status that puts them at risk for a subsequent illness, creating a cycle of poor growth and increased risk of illness."**

**- The Child Health Impact Working Group**

The lack of affordable housing and high heating costs force families to supplement their heating systems with alternative sources. A Morbidity and Mortality Weekly Report analyzed data on residential heating appliances used in homes across the United States between 1988 and 1994. The study revealed that 13.7 million adults reported using an unvented space heater during that

time period, and that 9.3% of households that had a gas stove for cooking used their stove for heating purposes at least once in the previous year.<sup>81</sup> Given the rise in heating costs and housing since 1994, it is likely that a higher proportion of families across the United States are supplementing their heating sources with gas stoves and other unvented appliances.

The lack of affordable housing in Rhode Island has forced many families to overcrowd their households to support multiple families in one unit. Overcrowding of homes has direct impacts on the health of residents, the level of stress in households, and the health and development of children growing up in those units. Overcrowding has been associated with the transmission of tuberculosis.<sup>82</sup> Studies have shown that elementary school children who live in more crowded homes, independent of social class, have higher levels of psychological distress, poorer behavioral adjustment at school, and lower social and cognitive competency.<sup>83</sup> Overcrowding disproportionately impacts certain populations. A study by the Center for Housing Policy found that immigrant working families are six times more likely to live in crowded conditions and are more likely to report a critical need for housing. This need for housing declines little despite the length of time immigrant families have lived in the United States.<sup>84</sup>

### **What are housing instability and homelessness costing Rhode Island?**

From July 1, 2004 to June 30, 2005, an all-time high of 6,408 people entered a Rhode Island emergency shelter.<sup>85</sup> Additionally, the number of children served by emergency shelters increased by 10% to 1,717. This increase continues the ongoing trend of more children and families being served by Rhode Island's emergency shelter system. The number of children in Rhode Island shelters has increased 36% since 2000.<sup>86</sup> Homelessness is disproportionately affecting Rhode Islanders of color. During the 2005 fiscal year, blacks were six times as likely than whites to be forced into an emergency shelter.<sup>87</sup>

Housing costs and poverty in Rhode Island are main drivers for the rise in emergency shelter use. Rhode Islanders using the emergency shelter system reported having no income and high housing costs as the top two reasons for seeking shelter.<sup>88</sup> Rhode Island's affordable housing shortage continues to grow. In 2004, the average rent in Rhode Island for a 2-bedroom apartment was \$1,121.<sup>89</sup> For a family in Rhode Island to afford this rent without spending more than 30% of their income on housing, they would have to earn \$45,000 a year. Half of the families in Rhode Island cannot afford this rent. Additionally, the state's population is growing four times faster than the production of new housing.

### **Effective Interventions: Evidence from local and national research**

Research suggests that permanent supportive housing programs can provide more comprehensive, effective services for the homeless, and can also reduce costs. Supportive housing provides both permanent housing as well as associate services such as food, drug and alcohol counseling, and GED courses. Research from the Partnership to End Long-Term Homelessness suggests that the cost to provide permanent supportive housing is lower than the cost for shelter services and other state services where the homeless may end up, such as prisons, mental hospitals, and medical hospitals. The study found the average daily costs for permanent supportive housing in Boston were \$33.45 per person, compared to \$40.28 for shelters, \$117.08 for prisons, \$541 for mental hospitals, and \$1,770 for medical hospitals.<sup>90</sup>

The HOPE VI Program has also been a strategy used to provide improved public housing for residents across the United States. HOPE VI, originally known as the Urban Revitalization Demonstration (URD), was developed as a result of recommendations by the National

Commission on Severely Distressed Public Housing. The Commission recommended revitalization in three general areas:

- physical improvements,
- management improvements, and
- social and community services to address resident needs.

The grants fund capital costs of major rehabilitation, new construction and other physical improvements, demolition of severely distressed public housing, acquisition of sites for off-site construction, and community and supportive service programs for residents, including those relocated as a result of revitalization efforts.

Recent proposed cuts to the HOPE VI program threaten to continue to allow severely distressed units to contribute to poor health outcomes of residents and neighborhoods and high costs for local housing agencies and the federal government. The Urban Institute estimates that between 47,000 and 82,000 severely distressed public housing units exist that are not currently scheduled for demolition and replacement.<sup>91</sup> While the cost to demolish and replace these units is high, the Urban Institute argues that the costs of continuing to operate and maintain these are also high. These units produce high maintenance and repair costs, have high vacancy rates, often require additional security costs as crime and violence are more prevalent in distressed units, and divert scarce resources from other public housing units.<sup>92</sup> Additionally, over-concentrations of public housing can reduce nearby home values and property tax revenues, in contrast to properly designed and maintained public housing units that maintain or even increase local property values.

Discussions of healthy housing are incomplete without including a discussion of affordable housing and economic development needs. Housing is not “healthy” unless it is affordable to the residents. Support for the implementation of the state’s five-year strategic housing plan and a policy agenda that addresses rising energy and housing costs will be critical if Rhode Island wants to reach its vision for healthy housing across the state.

## **DISABILITIES AND HOUSING ACCESSIBILITY**

### ***Impact on health and development***

Many families in Rhode Island and across the United States are affected by disabilities. More than 50 million people in the United States have a disability.<sup>93</sup> There are approximately 195,805 individuals with disabilities living in Rhode Island, representing approximately 20% of the state's population.<sup>94</sup> Additionally, Rhode Island has the 6<sup>th</sup> largest proportion of residents ages 65 and over in the United States.<sup>95</sup> As the state's population continues to age many of these elderly residents will be in need of accessible housing that meets their individual needs.

A significant proportion of individuals with disabilities in Rhode Island are living below the federal poverty level. From 2003 to 2004, the poverty rate for working-aged individuals in Rhode Island with disabilities increased from 25.7% to 26.5%.<sup>96</sup> Individuals with disabilities face additional barriers to transportation and housing that greatly impacts their ability to earn a living and to be self-sufficient. In 2005, the Rhodes to Independence Housing Workgroup conducted a qualitative study to reach a better understanding of housing-related issues for individuals with disabilities in Rhode Island and their families. The workgroup conducted two focus groups: the first focus group consisted of twelve participants who work at individual, community, state, and national levels to address issues of accessibility in housing; the second group included fifteen individuals who either have a disability or are a family member of a person with a disability. Key barriers expressed by participants in both groups included: statewide housing systems barriers; negative attitudes; lack of affordable, accessible and available housing; and the need for increased support services and education.<sup>97</sup> Participants noted that it is incredibly difficult to navigate the housing system in Rhode Island with or without a disability. Waiting lists for resources and assistance are incredible long, and participants felt that process is confusing and difficult. Participants spoke to the stigma that community members, city and town planners, and zoning boards have toward people with disabilities and the attitude that housing and educating individuals with disabilities will cut funding for other programs in cities and towns. Additionally, participants noted that when individuals do receive housing, it is often not safe and healthy: "When a housing unit does become available, nine times out of ten it is not accessible or it is not affordable or not safe, it never seems to be all of them."<sup>98</sup>

### ***What is the lack of accessibility costing Rhode Island?***

The majority of Rhode Island's housing stock is comprised of older, inaccessible homes with narrow doorways and small bathrooms. Many individuals living with disabilities in Rhode Island are in need of home modifications to make their homes safe. Home modifications are defined as "an adaptation to the living environment intended for ease of use, safety, security and independence."<sup>99</sup> Home modifications for individuals with disabilities and the elderly can include ramps, widening of doorways, accessible door hardware, handrails, accessible bathroom and kitchen features, emergency calling systems, and others.

Although there are certainly costs associated with providing home modifications for individuals with disabilities and the elderly, research shows up-front investments in home modifications have tremendous cost savings in the long-term. For example, the majority of home modifications needed for elders and individuals with disabilities could be completed with costs ranging from \$5,000 to \$50,000. Without these modifications many individuals end up living in nursing home care. Data from the Rhode Island Long Term Care Spending Report estimates that costs for elders or individuals with disabilities who are receiving care in nursing facilities

are approximately \$44,896 per individual each year.<sup>100</sup> In 2004, 89% (\$418,169,912) of Rhode Island's long term care Medicaid dollars were spent on institutional care, with only 9% of the total long term care dollars spent on home and community care programs.<sup>101</sup> The majority of the funding spent on institutional care (70%) was spent on nursing home care.

The lack of home modification services not only increases costs in nursing home care, but also can increase the length and costs of hospital stays. In 1994 the Franciscan Children's Hospital in Boston estimated that the hospital spent an additional \$452,950 due to the delayed discharges of seven children due to a lack of home modifications and other necessary services.<sup>102</sup>

**“The use of home modifications provides elders and people with disabilities the opportunity to live independently in the home environment of their choice which results in a cost savings to the state. The degree to which an individual has the necessary home modifications directly impacts his/her ability to be an active member of society; to work and pay taxes as opposed to being unemployed, collecting public assistance or costing the state money for unnecessary nursing home care.”**

**-Rhodes to Independence**

### **Effective Interventions: Evidence from local and national research**

Rhode Island currently has programs such as the Community Development Block Grants, the HOME program, Medicaid Waivers, and RI Housing Home Repair funds that can provide some assistance to individuals in need of home modifications. However, many programs have small amounts of funding or target specific communities or populations and are not meeting the demands of the elderly and disabled populations in Rhode Island.

In 1999, the state of Massachusetts developed a Home Modification Loan Program to address the needs of their aging population and their residents with disabilities. The initial \$10 million assisted over 300 adults and children with disabilities and elderly residents. It is estimated that the average loan per individuals was \$20,8000 and that each loan saved the state an estimated \$43,800 to \$127,750 per person.<sup>103</sup> The program was re-authorized in 2004 for \$25 million over five years. Rhode Island introduced legislation in the 2006 session modeled after the Massachusetts Home Modification Loan Program that was unsuccessful in passing the legislature. Continuing to advocate for legislation in Rhode Island that provides for funding for home modifications may create avenues for assistance to individuals with disabilities.

## **INJURIES**

### ***Impact on health and development***

Injury is the leading cause of death after the first year of life in the United States for children and adults under the age of 45 and comprises the greatest amount of medical costs in the developed world. Every year in the United States, 14 million children suffer from injuries that require medical attention. Unintentional injuries are the leading cause of death and disability for children, adolescents, and young adults in the United States. In 2002, unintentional injuries resulted in the deaths of more than 20,000 children, adolescents, and young adults ages 0 to 24 years. Unintentional injury deaths peak during ages 1-4 and again between ages 15-24. Types of injuries encountered by clinicians include the following: dislocations and sprains, open wounds, superficial injuries, contusions, burns, poisoning, intracranial injury, ingestion of foreign bodies and fractures. Unintentional falls are the most commonly encountered injuries in hospital, followed by being hit with objects.

### ***What are injuries costing Rhode Island?***

Injuries are a leading cause of morbidity and mortality for all Rhode Islanders, with injury disproportionately affecting Rhode Island's youth. While injuries are the fifth leading cause of death for Rhode Islanders of all ages, injuries are the leading cause of death for Rhode Island children ages 1-17.<sup>104</sup> Falls account for 20% of injury-related death, fires and burns account for 4.8%, and unintentional poisonings account for 2.1%.<sup>105</sup> For children ages 1-14, fire/burn accounted for 25% of injury-related death, suffocation for 13%, drowning for 8%, falls for 4%, and poisonings for 4% between the years 2000 and 2004.<sup>106</sup> Falls account for over half of injury-related hospitalizations in Rhode Island (51.7%), resulting in over 11,000 hospitalizations in the state from 1999-2003.<sup>107</sup> During the years 1999-2002, injuries were the second leading cause of years of potential life lost (YPLL) for Rhode Islanders, accounting for 28,161 years (20.5%) of potential life lost.<sup>108</sup> The annual lifetime cost of unintentional injury of children under the age of 14 is close to \$175 billion and is broken down as follows: direct medical costs account for \$10.1 billion, future earnings \$16.9 billion, and quality of life \$148 billion.<sup>109</sup>

### ***Effective Interventions: Evidence from local and national research***

Toddlers and children under the age of five are at greater risk for injuries that occur in the home such as fires, poisonings, suffocation, drowning, neglect or abuse. Many of the published studies focus on interventions that occur in the primary care setting and they have shown varying levels of success in terms of changing of parental behaviors, but have not shown to reduce the incidence of injuries.<sup>110</sup> Residential interventions have included educational home visits from community health workers and the provision of safety equipment such as smoke detectors.

The Oklahoma City Smoke Alarm Project was a community intervention trial that was instituted to reduce residential fire-related injuries and deaths in an area of Oklahoma City that was disproportionately affected by this problem. The distribution of free smoke alarms in targeted neighborhoods was accompanied by written educational pamphlets and a home visit by a community health worker to make sure the smoke detector was working correctly. During the six years following the project, the residential fire-related injury rate decreased 81% in the target population but only 7% in the rest of Oklahoma City (McDonald, 2005). This research was duplicated by Runyan et al. who found that fatal fire injury could be reduced by 71% through the use of smoke detectors.<sup>111</sup> The Council on Scientific Affairs anticipates that installation of sprinkler systems would prevent nearly all fire deaths and injuries.<sup>112</sup>

Another community-based study randomized 220 families who were facing stress and financial difficulties to a home visitation program. Families were enrolled in the program for up to 36 months and health outcomes were assessed at 6, 12, 24, and 36 months after enrollment in the program. Children enrolled in the program demonstrated statistically significant decreases in rates of hospital admission for injuries and poisonings, decreased parental assaults and increased positive parenting.<sup>113</sup>

A city based study of families with children under the age of 8 employed a research assistant to visit the homes of children to note specific, structured observations regarding the presence/absence of the following home safety hazards: access by children to small objects, matches, lighters, cleaning supplies, beauty supplies, medications, or electrical cords; windows which open easily beyond six inches; child resistant caps on medicines; tap water greater than 130°F; a functioning smoke detector on each house level; a fire extinguisher; safety gates at stairs; a baby walker; ease of opening basement door; certified bicycle helmets; and child seat restraints. Afterwards parents received a specific home injury prevention information package, a review of the visit findings and instruction on how to correct identified safety deficiencies, detailed instructions regarding each of the targeted safety devices, and coupons for reductions on car safety equipment. Over the 36 month follow up period the rate of injury visits to the doctor was significantly less for the children who received this intervention, but the effect of the intervention diminished with time.<sup>114</sup>

Since one-time visits from community health workers generally have not been successful, it would be helpful to provide families with multiple devices for home safety such as safety latches for kitchen cabinets and doors, safety gates for stairs, electrical outlet covers, anti-scald devices for faucets, and window guards, in the hope that they would offer many levels of protection for children and decrease the incidence of preventable childhood injuries presenting in emergency departments across the United States. While neighborhood-level factors certainly have a role in an individual's risk for injury and need to be addressed, an independent association between housing and injury exists. A recent study by Shenassa et al. found that the association between housing conditions and pediatric injury is independent of individual level factors such as race and gender as well as community-level determinants of injury such as neighborhood poverty level.<sup>115</sup> Thus, efforts that focus on housing conditions in specific units, regardless of neighborhood and individual level factors will be able to prevent some injuries in the home environment, especially for families with young children.

## **INDOOR AIR QUALITY**

### ***Impact on health and development***

Indoor air quality (IAQ) poses a major health threat in the United States. Research has shown that people spend more than 90% of their time indoors,<sup>116</sup> which results in continuous exposure to harmful toxins. In addition, most homes have more than one source of air pollution. Studies have shown that indoor air is more polluted than outdoor air.<sup>117</sup> Indoor air pollution (IAP) occurs when man-made and natural chemicals, gases, particles and other substances are produced or released in or near the home.<sup>118</sup> Factors that contribute to concentrations of IAP include inadequate ventilation and high temperature and humidity levels.

Sources of IAP include environmental tobacco smoke (ETS), biological contaminants, combustion products, volatile organic compounds (VOCs), asbestos, and radon (Rn).

- ETS, also known as secondhand smoke, is both the smoke emitted from a burning cigarette, pipe or cigar, and the smoke exhaled from the smoker.<sup>119</sup> ETS consists of more than 250 chemicals known to be toxic or carcinogenic. Secondhand smoke exposure can cause heart disease and lung cancer in nonsmoking adults and is a known cause of sudden infant death syndrome (SIDS), respiratory problems, ear infections and asthma attacks in infants and children.
- Biological contaminants include molds, mildews, fungi, bacteria, viruses, dust mites and animal dander. Sources include poor moisture control, leaks, humidifiers, air conditioners, pets and people. Health effects of biological contaminants include allergic sneezing, watery eyes, coughing, shortness of breath, dizziness, lethargy, fever, and digestive problems.
- Combustion products include carbon monoxide (CO), nitrogen dioxides (NO<sub>2</sub>), and particle matter. Combustion contaminants are derived from tobacco smoke and poorly vented space heaters, stoves, ovens, furnaces and fireplaces. Particles are released into the air when fuels are burned incompletely. Particles are inhaled and can cause lung tissue irritation or damage. Carbon monoxide and nitrogen dioxides are colorless, odorless gases released during combustion. Carbon monoxide interferes with the delivery of oxygen throughout the body.<sup>120</sup> Side effects of carbon monoxide poisoning include headaches, dizziness, weakness, fatigue, nausea, confusion, disorientation, and high concentrations can result in unconsciousness or death. Nitrogen dioxide poisoning irritates the mucus membranes in the eye, nose, and throat and causes shortness of breath after exposure to high concentrations.<sup>121</sup>
- Volatile organic compounds (VOCs) include benzene, formaldehyde, toluene, chloride, methylene, ethylene glycol, texanol and xylene. Sources of VOCs include new carpeting, new furniture, recent painting, chemicals stored in the home, recently applied adhesives, caulk or paint, insulation, new plastics or electronic devices. Health effects of VOCs consist of eye and respiratory tract irritation, headaches, dizziness, visual disorders, memory impairment and some are known to cause cancer.
- Asbestos is a mineral fiber that has been commonly used in a variety of building materials for insulation and as a fire-retardant.<sup>122</sup> Sources of asbestos include insulation on pipes and ducts, wood stove gaskets, ceiling tiles, resilient flooring and tiles, thermal



insulation, and fireproofing material. When asbestos-containing material is damaged or disintegrates with age, microscopic fibers may be dispersed into the air.<sup>123</sup> Inhaled mineral fibers over a long period of time can cause lung cancer and irreversible lung scarring, known as asbestosis.

- Radon is a naturally occurring, odorless, colorless, and tasteless gas that is produced from the decay of uranium found in soil and rocks. The gas enters homes through dirt floors, cracks in concrete walls and floors, floor drains, and sumps.<sup>124</sup> Radon is the second leading cause to lung cancer after cigarette smoking.

The effects of IAP can appear immediately or later in life and depend on the toxicity of the source and duration of exposure. Children, the elderly, pregnant/nursing women, those with existing health conditions, those that are poorly nourished, and most urban residents at any age are more susceptible to the effects of IAP. Exposure to pollutants can also worsen pre-existing conditions such as asthma. Smokers and former smokers exposed to some air pollutants, including radon and asbestos, have an increased risk for developing side effects. Immediate effects of IAP include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue.<sup>125</sup> Symptoms can occur after single or multiple exposures to the toxin, and many of these symptoms are contributed to other illnesses, which can make diagnoses difficult. Symptoms may only be apparent when near a contaminant and may persist until the illness is treated or the contaminant is contained. Long-term effects include some respiratory diseases, heart disease and cancer. Although immediate symptoms are typically short-term and treatable, long-term effects may take years to diagnose and can be fatal.

### **What is indoor air quality costing Rhode Island?**

As stated in this report, indoor air quality is impacted by several factors, each of which should be examined and analyzed for its cost and efficiency. Although several studies have been conducted to assess the cost of the quality of indoor air at the national level, local costs are not readily available, or haven't been done. For these reasons, this report includes several paragraphs detailing each of the factors that have an effect in indoor air quality, as well as the costs that were found for each of them, whether they were at the local or national level.

**Cigarette smoking** has been identified as the most important source of preventable morbidity and premature mortality worldwide.<sup>126</sup> Cigarette smoking and secondhand smoke exposure resulted in 438,000 premature deaths in the US during 1997-2001.<sup>127</sup> Smoking costs the United States over \$167 billion each year in healthcare costs including \$92 billion in mortality-related productivity losses and \$75.5 billion in excess medical expenditures.<sup>128</sup>

More than 126 million Americans continue to be regularly exposed to secondhand smoke in the home, at work, and in enclosed public spaces.<sup>129</sup> Nonsmokers exposed to secondhand smoke increase their risk of developing heart disease by 25-30% and lung cancer by 20-30%.<sup>130</sup> Secondhand smoke causes approximately 22,700 to 69,600 heart disease deaths and 3,400 lung cancer deaths annually in adult nonsmokers in the US.<sup>131</sup>

Children are especially vulnerable to the effects of secondhand smoke. Almost 60% of US children aged 3-11 years – or almost 22 million children – are exposed to secondhand smoke.<sup>132</sup> ETS is a known cause of sudden infant death syndrome (SIDS), respiratory problems, ear infections and asthma attacks in infants and children. ETS causes 1,900 to 2,700 sudden infant death syndrome (SIDS) deaths in the US annually.<sup>133</sup> Secondhand smoke is responsible for

between 150,000 and 300,000 lower respiratory tract infections in infants and children under 18 months of age, resulting in between 7,500 and 15,000 hospitalizations each year.<sup>134</sup> Ear infections from secondhand smoke exposure result in 700,000-1.6 million physician office visits per year. ETS exposure can cause children who already have asthma to experience more frequent and severe attacks.<sup>135</sup> ETS aggravates symptoms in 400,000 to 1,000,000 children with asthma.<sup>136</sup> In addition, there are an estimated 150,000 to 300,000 cases every year of infections, such as bronchitis and pneumonia, in infants and children under 18 months of age who breathe secondhand smoke, which results in between 7,500 and 15,000 hospitalizations.<sup>137</sup>

Although cigarette smoking among adults in Rhode Island is declining (19.8%), it has increased among adolescents; more than 25% of high school seniors now smoke.<sup>138</sup> Approximately 1,700 adults die each year from their own smoking and 130 to 230 adults, children, and babies die each year from secondhand smoke and pregnancy smoking in Rhode Island. Annual health care costs in RI directly caused directly by smoking are \$506 million. Residents' state and federal tax burden from smoking-caused government expenditures total approximately \$719 per household. Smoking-caused productivity losses in RI costs approximately \$364 million.

**Biological contaminants** include molds, mildews, fungi, bacteria, viruses, dust mites and animal dander. Exposure to biological contaminants can trigger asthma. Asthma is a lung disease that is characterized by airway constriction, chronic inflammation, and episodic wheezing and cough. Asthma is on the rise across the United States and in Rhode Island. From 1980 to 1995 the percentage of children in the United States with asthma doubled.<sup>139</sup> Additionally, asthma is the number one chronic health condition of children in the United States, and is the leading cause of school absences resulting from chronic illness.<sup>140</sup>

In the Third National Health and Nutrition Examination Survey, Lanphear et. al conducted a cross-sectional survey to identify residential risk factors for childhood asthma and quantify the relative contribution of these risk factors to asthma across the nation.<sup>141</sup> Researchers quantified the number of cases of doctor-diagnosed asthma in the study group that were attributable to residential exposures as 533,000 cases (39.2%).<sup>142</sup> These cases were estimated to account for \$402 million annually in costs annually for diagnosing and treating asthma for children under the age of six.<sup>143</sup>

Asthma rates have risen significantly over the last few decades. Across the nation, asthma prevalence in children ages 0-17 nearly doubled from 1980 to 1996, rising from 3.5% to 6.2%. The most recent data (2002) showed that 12.2% of children ages 0-17 had ever been diagnosed with asthma, 8.3% currently had asthma, and 5.8% had experienced an asthma attack in the previous year.<sup>144</sup> Over 160,000 children aged 0-14 years are hospitalized for asthma annually. Among all age groups, children aged 0-4 years had the highest hospitalization rate in 1993-1994 (49.7 hospitalizations per 10,000 persons). According to the 2002 Rhode Island Behavioral Risk Factor Surveillance System (RI BRFSS), one in ten Rhode Islanders currently have asthma, ranking Rhode Island as the state with the third highest asthma rate in the United States.<sup>145</sup>

Asthma results in higher annual disability claims for employees. Across the nation, per capita disability claims of employees with asthma are three times higher than those employees with no record of asthma treatment (\$14,827 vs. \$5,280).<sup>146</sup> Additionally, asthma results in 15 million missed workdays every year in the United States, resulting in nearly \$3 billion in lost productivity.<sup>147</sup>

**Carbon monoxide** (CO) is a dangerous combustion product that can be deadly in high doses. Carbon monoxide, which leads to more than 1,700 suicides and 500 accidental deaths every

year, remains one of the leading causes of poisoning death in the U.S.<sup>148</sup> According to the CDC, between 2001 and 2003, an estimated 15,200 persons with confirmed or possible non-fire-related CO exposure were treated annually in hospital emergency departments (ED).<sup>149</sup> During 2001-2002, an average of 480 persons died annually from non-fire-related CO poisoning.<sup>150</sup> Although males and females were equally likely to visit an ED for CO exposure, males were 2.3 times more likely to die from CO poisoning.<sup>151</sup> The non-fatal rate for CO exposure was highest for children aged  $\leq 4$  years (8.2 per 100,000 population), whereas the CO death rate was highest for adults  $\geq 65$  years (0.32 per 100,000 population).<sup>152</sup> Adults aged  $\geq 65$  years accounted for 23.5% of CO poisoning deaths.<sup>153</sup> The death rate was highest for non-Hispanic whites and blacks (0.17 per 100,000).<sup>154</sup> Approximately 64.3% of the nonfatal CO exposures occurred in homes.<sup>155</sup> CO exposures occurred more often during the fall and winter months, with the highest numbers occurring during December (56 fatal and 2,157 nonfatal exposures) and January (69 fatal and 2,511 nonfatal exposures).<sup>156</sup>

Health effects of **VOCs** consist of eye and respiratory tract irritation, headaches, dizziness, visual disorders, memory impairment and some are known to cause cancer. At this time, there is insufficient data on the number of deaths or injuries related to exposure to volatile organic compounds or the associated healthcare costs.

Mesothelioma is a cancer of the pleural and peritoneal lining of the lungs. Approximately 70-80% of all cases of mesothelioma have been proven to be the direct result of asbestos exposure.<sup>157</sup> It is estimated that 8 million Americans have been exposed to dangerous levels of asbestos and between 43,000-230,000 have died as a result of asbestos-related cancer.<sup>158</sup> Mesothelioma has a latency period of ten to fifteen years and can be asymptomatic throughout that time. Approximately 2,000-3,000 new patients are diagnosed with mesothelioma each year in the United States.<sup>159</sup> Over 25% of those dying from mesothelioma worked in the building or maintenance industry.<sup>160</sup> 85% of mesothelioma cases are male. It is estimated that more than 110,000 schools in the US still contain some form of asbestos, which results in a high rate of mesothelioma among schoolteachers, many whom are female.<sup>161</sup> The average survival rate in those diagnosed is one year unless the cancer is found early and treated aggressively, which can extend the survival rate 2-5 years. There is no cure for mesothelioma and the cost of treatment ranges from \$400,000-\$800,000.<sup>162</sup> Although mesothelioma data revealed the deadly effects of asbestos exposure over 60 years ago, it is still used in over 5,000 products worldwide.

Approximately 8 million homes in the US have elevated levels of **radon**.<sup>163</sup> Radon is the second leading cause of lung cancer, second to smoking. It is estimated that 10-14% of lung cancer deaths in the US and 6-15% of lung cancers worldwide can be attributed to radon.<sup>164</sup> Every year, there are 21,000 lung cancer deaths, it is estimated that 2,900 are among nonsmokers and 18,100 are among smokers whose risk for cancer is increased.<sup>165</sup> Lung disease costs the American economy \$81.6 billion in direct healthcare expenditures every year, plus indirect costs of \$76.2 billion – a total of more than \$157.8 billion.<sup>166</sup>

Approximately 1/3 of radon induced lung cancer could be avoided if home radon concentrations were reduced below the EPA action level of 4 pCi/L of air.<sup>167</sup> The cost of making repairs to reduce radon levels depends on how your home was built and other factors. Most homes can be fixed for about the same cost as other common home repairs or a contractor can be hired to lower radon levels in a home which the price ranges from \$800 to about \$2,500.<sup>168</sup>

Approximately 23% of the homes in Rhode Island have radon levels that exceed the level considered acceptable by the Environmental Protection Agency (EPA). Of these, about 1-2% has radon levels 5 times the accepted standard.<sup>169</sup> Approximately 90% of all schools and 85% of all

state and municipal buildings in RI have completed initial radon testing.<sup>170</sup> There are an estimated 100 deaths per year in Rhode Island due to radon-related lung cancer.<sup>171</sup>

**Effective Interventions: Evidence from local and national research.**

Three strategies used to improve indoor air quality are source control, improved ventilation and air cleaners. Source control is the most efficient and cost effective method and involves eliminating individual sources or reducing their emissions. Ventilation removes heat, humidity and dilutes air pollutants by moving indoor air outside and increasing the amount of outdoor air coming indoors. Ventilation improves indoor air quality but can increase energy costs. Effective ventilation strategies to increase the outdoor ventilation rate include opening windows and doors, operating window and attic fans when weather permits, running window air conditioners with the vent control open.<sup>172</sup> Harmful activities including painting, paint stripping, heating with kerosene heaters, cooking, welding, soldering, and sanding should be done outside when weather permits to prevent polluting indoor air. Bathrooms, clothes dryers, kitchen ranges, boilers, furnaces, hot water heaters, fireplaces, and wood burning stoves with exhaust fans also increase the ventilation rate by removing contaminants from the room where the exhaust fan is located.

Air cleaners are available in a variety of models, which range in price, size and efficiency. Various air cleaners available include mechanical filters, HEPA filters, electronic air cleaners, electrostatic precipitators, hybrid filters, and gas phase filters. Filters can be portable units, which are used when air cleaning in a room is desired, or central filtration systems that are used when whole-house cleaning is needed. The effectiveness of an air cleaner depends on how well it collects pollutants from the air, how much air it draws through the cleaning or filtering element, and whether it removes particles, gases or both.<sup>173</sup> Three types of air cleaners are tabletop units, room units and central filtration systems. *Consumer Reports* magazine tested nine tabletop units and found that, because they can move only small amounts of air, they suffice only for a very small room or a portion of a room.<sup>174</sup> Room units tested by *Consumer Reports* magazine circulated more air than tabletop units. The highest efficiency for smoke and dust removal was observed in a room unit utilizing electrostatic precipitation.<sup>175</sup> Mechanical filters such as HEPA filters, which remove particles at a minimum of 99.97% efficiency, and electronic air cleaners, can effectively trap large and small particles.<sup>176</sup> Reviews by *Consumer Reports* and Fox suggest that a highly efficient room unit is more effective at removing pollutants in the room where it is located than a central filtration system.<sup>177</sup>

Indoor air pollution created by environmental tobacco smoke (ETS) can be reduced or eliminated by quitting smoking, not smoking indoors, choosing schools and businesses that are smoke-free, and opening windows or using fans to move smoke outside. Air cleaners can also remove some tobacco smoke particles and gaseous pollutants.

Controlling humidity levels through proper ventilation can reduce air pollution generated by biological contaminants. Biological contaminants can be removed or reduced by using outside-vented exhaust fans, increasing outdoor-air ventilation, repairing any leaks or water damage, regular cleaning, and controlling exposure to pets.

Air pollution resulting from combustion products can be removed or reduced by inspecting and maintaining furnaces, water heaters, and clothes dryers. Flues of stoves and exhaust systems should also be checked and exhaust fans that vent outside should be used. Carbon monoxide detectors are available.

Pollutants from volatile organic compounds (VOCs) can be reduced if used and stored properly, outside-vented exhaust is used and if ventilation is increased. VOCs should be used outside when possible.

Asbestos can be contained or eliminated if materials are sealed or closed. A professional can also remove asbestos. The EPA requires professional removal when there is a significant risk of exposure to the public.

Increasing ventilation or sealing cracks in floors, walls and ceilings can reduce exposure to radon gas. Radon test kits are available at retail stores and through mail order. A contractor can do the testing but it is not necessary. The cost of making repairs to reduce radon levels depends on how your home was built and other factors. Most homes can be fixed for about the same cost as other common home repairs, like painting or having a new hot water heater installed. The average cost for a contractor to lower radon levels in a home can range from \$800 to about \$2,500. Testing devices should be placed in the lowest level of the house, with doors and windows closed and take two to ninety days to complete.<sup>178</sup>

## **NOISE**

### ***Impact on health and development***

There is an abundance of literature on the various health effects associated with environmental exposures to lead, allergens and injuries on children, but little research has been performed of the effects of ambient noise. It is known that exposure to excessive amounts of noise can damage a child's health from the gestational period onwards. Maternal exposure to excessive noise during pregnancy has been associated with low birth-weight and noise induced hearing loss in infants.<sup>179</sup> Studies have shown that preterm babies who are housed in noisy neonatal intensive care units have developed undesirable physiologic and behavioral effects.<sup>180</sup> Moreover, a recent large-scale cross-sectional study comprised of 2,844 children ages 9 and 10 in different European countries found highly significant associations between exposure to road traffic noise and memory loss, as well as with general annoyances; children who were exposed to aircraft noise suffered from decreased reading comprehension and recognition memory.<sup>181</sup> An Austrian study of 1,280 children investigated the association of highway, rail and road noise on the mental health of school children living in several different towns. Exposure to ambient noise was associated with small decrements in children's mental health and poorer classroom behavior.<sup>182</sup>

### ***Effective Interventions: Evidence from local and national research***

Few community noise studies have been scientifically evaluated, but they generally fall into the following categories: hearing conservation programs in schools; noise abatement policies; improved design and layout of new housing developments; reduced proximity of residential and commercial/industrial properties; installation of increased sound insulation in homes; and education of the general public on noise and its effects. The majority of ambient noise studies examine children who live near airports or in noisy industrial areas, but few have looked at the effect of noisy neighborhoods on child health. One such Austrian study sought to do this by examining children who lived in small towns and villages near noisy roads. Children who were exposed to higher levels of noise had elevated resting systolic blood pressure and elevated heart rate reactivity when given a laboratory administered reading test. Moreover, they rated themselves higher in perceived stress symptoms on a standardized index. Furthermore girls evidenced diminished motivation in a standardized behavioral protocol.<sup>183</sup>

Published interventions for children suffering from noise have generally been administered in the school setting and focus on the risk for noise induced hearing loss, over the other physical and mental health risks associated with excessive noise exposure.<sup>184</sup> One such study targeted a group of Wisconsin youths ages 16-18 who were exposed to noise from industrial farming equipment. The intervention included lectures at school on the anatomy of the ear; testimonials from people who had noise induced hearing loss, noise level monitoring in the students' homes, free hearing protective devices that were replaced as needed, and yearly hearing tests. This intervention took place over a four-year period. Although no cost was mentioned, this intervention is likely to be very costly due to its nature and extent. When surveyed after the intervention, 81% of the students said they would use hearing protective devices if placed in a noisy situation again. It should be noted that data were self-reported.<sup>185</sup>

Despite a lack of published home-based interventions for residential noise, it is well documented that noise levels in American households are on the rise. As a result, children grow up increasingly chaotic environments and are constantly over-stimulated. Low-income children are disproportionately affected by this exposure, most likely as a result of overcrowded neighborhoods and poor urban planning.<sup>186</sup> Although there exists an assortment of federal, state and local laws to regulate community noise, many of these laws have conflicting purposes, such

as differences in the sound level limits that each regulation imposes on a given source or other differences.

Since home visiting interventions have shown success in the past for other environmental health exposures, home noise assessments from community health workers may be a viable option for residential noise interventions. After such a visit, a community health worker could provide the homeowner with the results of the assessment, as well as with the necessary insulating materials. To keep the costs of this intervention low, this visit would have to be a one-time assessment, but the provision of insulation for windows in apartments or houses could help decrease noise exposure.

## **SECTION III. NEIGHBORHOOD LEVEL CONSIDERATIONS**

While the majority of this report focuses on individual household level triggers and pathogens for morbidity and mortality, it is important to note that many factors at the community and neighborhood level also play a critical role in the health of Rhode Islanders.

### **Toxins**

A joint report by the National Environmental Trust, the Physicians for Social Responsibility, and the Learning Disabilities Association of America examines the impact, effects, and costs of toxic chemical emissions on the health of United States residents. More than half of all toxic chemical emissions reported to the Environmental Protection Agency's Toxic Release Inventory in 1998 were known or suspected developmental or neurological toxins.<sup>187</sup> However, the majority of chemicals released have never been tested for neurotoxic effects, making the proportion of chemical emissions that are toxicants a likely underestimate of the true burden of these emissions. A report by the National Academy of Sciences estimates that 3% of developmental and neurological defects in children are caused by exposure to known toxic substances<sup>188</sup>, resulting in \$240 million in annual lifetime costs for diagnoses and treatment of developmental disabilities<sup>189</sup>. Again, as these figures focus solely on known chemical toxins, this is likely an underestimate of the health and cost impact that chemical releases have in the United States. While an immediate need to reduce environmental health hazards focuses on the indoor home environment, community organizations, local, city, state, and federal government agencies need to also think broadly on policies that can provide additional benefit in reducing the cost and health burden of these environmental health hazards.

### **Transportation, Air Pollution, and Asthma**

The outdoor environment also contributes to asthma and respiratory symptoms. Motor vehicles are the leading cause of air pollution, which has a number of negative health impacts.<sup>190</sup> Higher ozone levels have been associated with a higher incidence and severity of respiratory symptoms, higher rates of emergency room utilization, and higher rates of absenteeism from work and school.<sup>191</sup> Motor vehicles are the leading cause of air pollution. As cities have continued to sprawl and public transportation systems continue to lack in resources and service reach, individuals rely more and more on motor vehicles for transportation. During the 1996 Summer Olympic Games in Atlanta, Georgia, the state instituted a plan to reduce automobile congestion in the city and promoted widespread use of public transportation. The efforts taken by Atlanta to increase the use of public transportation led to a 28% decline in daily ozone concentrations and a 41% decrease in asthma acute-care events in emergency rooms and clinics.<sup>192</sup> Poor outdoor air quality and air pollution disproportionately affect those that are low-income and people of color. Data from the Environmental Protection Agency revealed that blacks and Hispanics are more likely to live in areas that are in violation of air quality standards than whites.<sup>193</sup>

### **Obesity**

Obesity and its health consequences such as diabetes, high blood pressure, and high cholesterol accounted for 9.1% of the total annual medical expenditures in the United States in 1998.<sup>194</sup> The rise in obesity in the United States and in Rhode Island is attributable to a number of factors such as sedentary lifestyles, a lack of physical activity, poor nutrition and food choices, and heavy reliance on automobiles for transportation. However, neighborhood resources and the physical design of communities also have an impact on obesity rates. A study of diabetic adults in East Harlem, New York found that foods necessary to maintain a diabetic diet were more



expensive and often unavailable in their local neighborhood stores.<sup>195</sup> The location and availability of supermarkets with healthier food choices are disproportionately available in white neighborhoods. There are fewer supermarkets in predominantly black neighborhoods compared to white neighborhoods and supermarkets are located further in distance from predominantly black neighborhoods.<sup>196</sup> African-Americans, Hispanics, and individuals living in economically disadvantaged areas are more likely to be obese.<sup>197</sup> Additionally, unsafe neighborhoods and communities make it difficult for individuals to exercise for fear of physical harm in their communities. Data from the Moving to Opportunity study confirms the impact on obesity that neighborhood level factors have on individuals' health. Moving to Opportunity utilized housing authorities in five U.S. cities between 1994 and 1998 to examine the impact of moving families from distressed public housing units in extremely poor neighborhoods into low-poverty neighborhoods. Data from this study revealed that obesity was reduced by 11% among adults who moved from high-poverty to low-poverty neighborhoods through the program.<sup>198</sup> Therefore, while there are a number of individual level behaviors that impact obesity rates, the design of communities and the resources within them are also critical factors in the fight against rising obesity rates.

Neighborhood safety, affordable housing policies and programs, poverty, and other community-level factors have a tremendous impact on the health and well being of Rhode Islanders. The Healthy Housing Collaborative recognizes that interventions and policies that impact both the household and community levels will be critical to moving forward an agenda for healthy housing in Rhode Island.

#### **SECTION IV. WHAT CAN WE DO TO ACHIEVE THIS VISION?**

A number of local, state, and regional resources already exist that can be used to leverage the vision of healthy housing in Rhode Island. The following recommended action steps address opportunities for short-term action through existing infrastructures in Rhode Island, as well as long-term policy and action objectives.

The recommended action steps outlined below arose from three main sources:

1. Stakeholder interviews conducted with nine key agencies in the state (Appendix 2 provides the full summary of the interviews);
2. An assessment of five key state strategic plans that identified overlapping objectives among many of the plans (Appendix 3 provides a full summary of the strategic plan assessment); and
3. Brainstorming and visioning exercises completed by the Healthy Housing Collaborative.

## **Data and Research Objectives and Action Steps:**

**Objective 1:** Utilize local colleges and universities to set forth a research agenda for “Rhode Island Best Practices” related to healthy housing interventions as well as research linking health outcomes to unhealthy housing conditions.

### **Action Steps:**

- Participate in discussions between HEALTH and Brown University to identify research opportunities to study the link between health outcomes and unhealthy housing conditions, school outcomes (special education, etc.), and other needed research questions.
- Work with local colleges and universities to develop solid evaluation plans for all pilot programs designed to study the effectiveness and cost savings (short and long term) of healthy homes interventions.

**Objective 2:** Assist cities and towns in the development and rehabilitation of “healthier” housing.

### **Action Steps:**

- Identify low-cost, healthy building methods to provide models that key groups can utilize in their decisions to purchase/use building materials. Disseminate this information to the RI Builder’s Association, the 39 cities and towns, the Public Housing Authorities, the Community Development Corporations, non profit developers and others.
- Develop basic specifications for a “healthy housing unit” that can disseminated and used by groups creating and rehabilitating housing units in the state.

**Objective 3:** Work with utility companies to reduce shut-offs, especially for vulnerable populations, to reduce poor health outcomes as a result of a lack of heat.

### **Action Step:**

- Map addresses where shut offs occur and correlate with other environmental health issues (asthma, lead, injury, etc.).

**Objective 4:** Promote the sharing, linking, and creation of health and housing data.

### **Action Step:**

- Create a statewide housing database containing critical health and housing information such as quality, affordability, and accessibility of housing units.

**Objective 5:** Standardize the collection of healthy housing information through existing infrastructures.

### **Action Steps:**

- Work with the Head Start agencies to develop a standardized assessment tool for all home visits.
- Continue to gather and monitor the housing quality information gathered through the Family Outreach Program.

## **Training Objectives and Action Steps:**

**Objective 1:** Work through existing agencies and infrastructures to ensure improved visual and environmental assessments of home environments in Rhode Island.

### **Action Steps:**

- Train the state's minimum housing code and building code officials on actions to take to improve the quality of Rhode Islanders' home environments.
- Coordinate training for groups including, but not limited to, Head Start teachers and family workers, the Public Housing Authorities, and the state's minimum housing code and building code officials;
- Conduct trainings with family workers and teaching staff from Head Start Agencies on healthy housing and visual assessments in homes.
- Provide training for the Providence Housing Authority and other Public Housing Authorities in the state on mold identification and remediation and other healthy housing topics.
- Identify additional key agencies and officials in need of training on healthy housing and in-home visual assessments.
- Identify opportunities to test for other measurable toxins such as pesticide residue levels, radon, carbon monoxide, and others in units already being tested for lead.

## **Reporting Objectives and Action Steps:**

**Objective 1:** Improve awareness of and knowledge about the impacts of housing on health among the general public, legislators, and key agencies in the state.

### **Action Steps:**

- Issue a joint report between the Housing Resources Commission and the Department of Health in 2008 on progress from the cities and towns toward compliance with the Low and Moderate Housing Act and the Plan to Eliminate Childhood Lead Poisoning. Include data on housing quality, code violations, affordability and others.
- Work with research/advocacy agencies to develop an issue brief highlighting the need for improved investments in healthy housing activities.

## **Policy and Fiscal Objectives and Action Steps:**

**Objective 1:** Seek private funds and partners such as Medicaid and Managed Care Organizations to reimburse for environmental interventions that can lead to long-term health care savings.

### **Action Steps:**

- Work with the Department of Health's Asthma Control Program to identify funds for and pilot the efficacy of environmental interventions for children with asthma through "Asthma Centers."

**Objective 2:** Support and/or introduce legislation that will improve financing of healthy housing activities for property owners and low-income families.

### **Action Steps:**

- Support the implementation of a home modification loan program for individuals with disabilities.
- Support the expansion of the Emergency Housing Assistance Program (EHAP).
- Support additional financing assistance for landlords to safely rehabilitate rental units that will be maintained affordable.
- Support additional funding for energy assistance for low-income households.
- Support the State Energy Office in seeking additional funds for piloting other health and safety improvements (IPM, window replacement, etc.) during Weatherization work.
- Track and monitor federal healthy housing legislative efforts and identify any model tools or incentives that could be utilized in long-term legislative efforts in RI.

**Objective 3:** Ensure thoughtful and well-planned use of the DuPont funds acquired through an agreement with the Office of the Attorney General.

### **Action Steps:**

- Maintain involvement in the Attorney General's subcommittees working to coordinate the use of the DuPont funds.
- Advocate for the use of funding to train city and town code enforcement officers to assist in enforcing compliance with the state's Lead Hazard Mitigation Law.

## **Additional Long Term Actions:**

In the long-term, we believe that the following actions will be necessary to make healthy housing a reality for all Rhode Islanders:

- Improve enforcement of state housing issues and housing code;
- Reduce programmatic barriers at the state and local level, such as limitations on the use of funding streams for cross-program/agency work;
- Improve coordination between code enforcement agencies and the housing court system to promote more efficient enforcement of housing violations;
- Work with DCYF to change the policy of licensing home-based day cares to require improved housing quality assessments.
- Work with the Office of Planning and Development to develop strong performance measures for the healthy lifestyle goals on the 5 Year Strategic Housing Plan and the Land Use 2025 Plan.

The above objectives and action steps are the beginnings of an action plan for healthy housing in Rhode Island. The next step in the process will be to develop a timeline in which the recommended actions can be completed, and identify agencies or individuals responsible for ensuring their completion. As part of the revised Memorandum of Understanding between the Housing Resources Commission and the Department of Health for January 1, 2007 - December 31, 2007, a timeline for action as well as measures to evaluate progress based on the above recommendations will be developed and approved by the Healthy Housing Collaborative.

It is clear that Rhode Island families are suffering from health and economic impacts as a result of unhealthy, unaffordable, and unsafe housing. We hope that this document will serve as a catalyst for the development of specific, measurable, and realistic actions among state and community agencies that will impact the lives of Rhode Islanders. We believe that all Rhode Islanders have a right to a safe, health, and affordable home. We believe that Rhode Island has a number of tools and resources that are already available to start working toward this vision. We believe that significant initial investments in improving healthy housing across the state will have substantial impacts in the long term. Making a commitment to healthy housing in Rhode Island is a smart, long-term economic investment that will improve health outcomes, lower social service costs, and ultimately promote sustainable communities.

**SECTION V. APPENDICES**

**RI HEALTHY HOUSING MATRIX ..... 39**  
**STAKEHOLDER INTERVIEW SUMMARY ..... 43**  
**STATE STRATEGIC PLAN ASSESSMENT..... 53**  
**MEMORANDUM OF UNDERSTANDING BETWEEN THE RHODE ISLAND DEPARTMENT OF  
HEALTH AND THE HOUSING RESOURCES COMMISSION: JANUARY 2006 ..... 56**  
**MEMORANDUM OF UNDERSTANDING BETWEEN THE RHODE ISLAND DEPARTMENT OF  
HEALTH AND THE RHODE ISLAND HOUSING RESOURCES COMMISSION ..... 59**  
**RI HEALTHY HOUSING COLLABORATIVE MEMBERS..... 63**

# RI Healthy Housing Matrix

## Evidence-based high priority list for research and intervention

Pathogen/Allergen	Exposure Levels	Health Effects	Population Rates	Geog Index GIS	Cost of Illness or Disability	Preventive Actions	Cost	Effectiveness
Dust from lead-based paint; chipping and peeling lead-based paint	Measured as micrograms of lead per deciliter of blood	Impaired neurobehavioral development	Incidence in RI, 2005: 621/31,669 (2%)	Cases of lead poisoning concentrated in the core cities (where child poverty level is greater than 15%)	Total RI cost: avg. \$4 mil/year	Abatement of lead hazards	Varies by extent	Full removal of lead hazards; removal of pathogen
Lead in soil	Goal: 0 mcg/dL	Decreased IQ	Incidence in RI core cities, 2005: 3.4%	Central Falls	RI Costs 2004: ▪ Medical costs: approx. \$300,000		Up to \$30,000 - \$40,000 per unit	
Lead in water	Lead poisoning is defined by CDC as 10 mcg/dL	Decreased cognitive function	Prevalence in RI, 2005: 3.0%	Newport	▪ Special education costs: approx. \$1 mil	Lead Hazard Reduction	Varies by extent	Control of hazards, exposure reduction; requires regular maintenance
Lead in consumer products		Learning disabilities		Providence	▪ Juvenile justice costs: approx. \$3 mil		Avg \$7,000 to \$10,000 per unit	Exposure reduction/moderate repairs; requires regular maintenance
		Stunted growth		Pawtucket	▪ \$3-6 million tax dollars lost to decreased future earnings	Spot repair/removal	Varies by extent	Temporary, one-time method
		Hearing loss		West Warwick				
		Hyperactivity		Warwick				
		Adverse effects on CNS, kidneys, hematopoietic system				Wet cleaning/Professional cleaning	\$290-675 per unit	
Molds	Varies by individual susceptibility/	Asthma	RI has third highest asthma rate	Children hospitalized for asthma	Hospital care (ER, inpatient, outpatient);	Mattress covers/bedding encasement	Approx	Needs vary by child, therefore effectiveness can also
Animal dander		Airway						



<p>Cleaning and household products</p> <p>Air pollution</p> <p>Combustion by-products</p> <p>Environmental tobacco smoke</p> <p>Dust mites</p> <p>Cockroach/rodent droppings</p> <p>Dry heat</p> <p>Lack of heat</p> <p>Volatile Organic Compounds (VOC's)</p>	<p>individual triggers</p>	<p>constriction Chronic inflammation</p> <p>Wheezing</p> <p>Cough</p> <p>ER visits/hospitalization</p>	<p>One in 10 Rhode Islanders have asthma</p> <p>One in 8 African-Americans in RI have asthma</p>	<p>more likely to reside in core cities:</p> <p>Rate/1000 children in core cities: 5.2</p> <p>Rate/1000 in remainder of RI: 2.7</p> <p>Rate/1000 by race:</p> <p>Black: 7.0</p> <p>Hispanic: 4.6</p> <p>Asian: 3.0</p> <p>White: 3.0</p>	<p>Medications, Physician services, Lost school days, premature death</p> <p>National data:</p> <p>15 million missed workdays annually (\$3 billion in lost productivity)</p> <p>Higher disability claims for employees with asthma (\$14,827 vs. \$5,280)</p> <p>\$2.0 billion: est. of environmentally attributable cost of pediatric asthma</p>	<p>Cleaning/HEPA vacuuming</p> <p>Pest management</p> <p>Home visiting and education</p>	<p>. \$1,500 - \$2,000 per child for long term intervention/visiting program</p>	<p>vary; more research needed in this area; programs need to be tailored to each child?</p> <p>Decreases in cockroach allergen, dust mite allergen levels, fewer days with symptoms, fewer ER visits, decreased in severity of asthma</p>
<p>Pesticides/Household products</p>		<p>Poisoning</p> <p>Learning problems</p> <p>Behavioral problems</p> <p>Developmental issues</p> <p>Immune system effects</p>	<p>National data:</p> <p>In 2003, poison control centers reported 113,000 cases of pesticide poisoning</p> <p>Study of 316 women of color in Manhattan: 85% reported use of pesticides</p>	<p>Concentrated use in urban settings (for indoor pesticide use)</p>		<p>Safe storage of household products</p> <p>Integrated pest management (blocking entry to home; reduce availability of food/water sources; trapping and low toxicity pesticides)</p>		<p>Effective, but requires participation on many levels, maintenance, and vigilance</p>

			in home during pregnancy			Community level IPM (sanitation, code enforcement, education)		
Rodents		Bites LCMV, viruses		Bites disproportionately affect children under age 1		Integrated pest management (blocking entry to home; reduce availability of food/water sources; trapping and low toxicity pesticides)  Community level IPM (sanitation, code enforcement, education)		
Housing instability/homelessness	N/A	Higher mortality  Lower rates of primary care service utilization (immunizations, lead screening, etc.)  Malnutrition/ food insecurity	July 2004 – June 2005: all-time high of 6,408 people entered RI emergency shelter  Number of children in RI shelters has increased 36% since 2000	Disproportionately affects people of color: Blacks six times as likely as whites to be forced into a shelter		Permanent supportive housing; More subsidized, affordable housing; Improved supportive services; Lower energy costs	Estimated daily cost of supportive housing in Boston  \$33.45 /person compared to  \$40.28 for shelters, \$541 for mental hospitals, \$1,770 for	Extensive policy and program changes needed; many resources needed

							medica l hospi tals	
Unintentional injury	N/A	Wounds; sprains; dislocations; fractures  Burns  Poisonings  Intracranial injury	Leading cause of death for RI Children ages 1- 17  Falls account for 20% of injury- related death; fire/burns for 4.8%; poisonings for 2.1%  11,000 hospitalizations from 1999-2003		Hospital care (ER, inpatient, outpatient); Medications, Physician services, premature death	Installation of smoke/CO detectors  Safety latches for cabinets  Safety gates for stairs  Electrical outlet covers  Anti-scald devices  Window guards		71% reduction of fatal fire injury through appropriate use of smoke detectors
Noise		Memory loss  Decreased reading comprehension and recognition memory  Decrements in children's mental health  Decreased language skills  Increased aggressive behavior in infants and toddlers				Improved design and layout of housing developments  Reduced proximity to industrial properties  Sound insulations  Hearing conservation in schools		

# **Stakeholder Interview Summary**

**September 28, 2006**

Overview/Summary

## **Process for Selection/Prioritization**

At the October 18, 2006 Healthy Housing Collaborative meeting, the group brainstormed criteria for interviewing individuals and agencies that the group felt would be the most critical to the process of understanding what resources are currently being spent and what data are currently being collected related to healthy housing issues. Key criteria for inclusion in the first round of interviews included:

- 1) Groups or agencies that are actively involved in the collection of data or who are a collection point for data related to these issues.
- 2) Agencies (including all relevant state agencies) that are already actively intervening or using resources to make housing safer and healthier.

The following interview questions were developed with input from the Healthy Housing Collaborative and were used in a interview format that was administered to several key stakeholders in the lead poisoning prevention and housing arena.

## **Overview of Interview Questions**

- 1) Can you briefly describe the programs that your agency runs?
- 2) Where does the funding for you programs/activities come from?
- 3) How long will this funding be available? (You may only have to ask this of certain agencies.)
- 4) What exact activities does this funding cover?
- 5) Are there restrictions on the use of the funding? If yes, what are the frustrations involved with these restrictions? If your funding were not restricted in scope, what would be the activities you would like to undertake?
- 6) What parts of your program do you feel are working well?
- 7) What are the opportunities for improvement?
- 8) What is your "next wish" that if you had additional funding you feel is a high priority that you would like to work on?
- 9) What are key problems/barriers your agency faces with regard to healthy housing activities?
- 10) What data, if any, are collected as a part of your work? In what format? Would you be willing to release these data to HEALTH and HRC and if so, what is the process for releasing data?
- 11) Does your agency have any plans in the near future related to healthy housing?
- 12) Are there ways in which you feel that your work could be assisted by HEALTH or HRC? What additional leadership would you like from our agencies?
- 13) In the future, we hope to work on a number of new collaborations and pilot programs to look at more comprehensive strategies to address environmental health problems in the home. Would you be interested in collaborating with us on future efforts?
- 14) Does staff from your agency come into contact with families in their homes? How frequently? What is the duration and frequency of this interaction?
- 15) What populations/neighborhoods are currently being served?

## Interview Summaries

### Bill Morrissette (REACH Program)

**Overview of Program:** REACH is the Residential energy assistance challenge option under the Low Income Heating Assistance Program (LIHEAP). The 1<sup>st</sup> round of the grant that RI received was a pilot involving intensive case management for single mothers working to increase self-sufficiency and reduce assistance needs. The 2<sup>nd</sup> round of funding is focused on the degree to which energy conservation can improve the health of the elderly. The project focuses on 600 seniors, working on appliance management, energy conservation and education, and measuring key health impacts.

**Funding stream and amount:** Subset of LIHEAP funding. \$1.1 million over three years spread among the seven CAP agencies in the state.

**Funding cycle/duration:** The state has received the grant for two cycles, one from January 2003-December 2005 and the second for January 2006 – December 2008. The RFP is released annually. Tri-Town CAP coordinates the funding but it must go through the State Energy Office.

**Data currently collected:** Have data on the 327 clients served through the 1<sup>st</sup> round of the program. Much of the data focuses on exit surveys from the clients: did they find the energy education valuable? Changes in behavior? Changes in thinking? Research results from this 1<sup>st</sup> round are being compiled by RIC School of Social Work and should be ready for dissemination within the next few weeks. New project will collect data on health (mobility, # of days hospitalized, etc.), energy security scale (includes measure of supplemental heating sources, perception of control, healthy homes questionnaire. All 7 CAP's participate, so the sample is representative of elderly throughout the state.

**Challenges:** Families/Cientele have so many issue to deal with that it is difficult to know where to begin and what to spend time, energy, and funding on.

**Next Wishes:** Would like to provide air conditioners for the elderly (liability issues, would have to be vigilant about installing them and then removing in the winter months). Would like to be able to replace windows and doors in homes.

**Opportunities:** May be able to utilize the same questions for this round as in the FOP questionnaire. This would give us data on 600 elderly homes in addition to the data on newborns collected through the FOP. Since funding is spread among the 7 CAP agencies, there is never any funding to spend on physical products; most goes to services and education. Opportunities for working across grants to provide more products for interventions in homes in the next round of REACH grants? Tri-town must disseminate the information to the public. There are opportunities to collaborate with some of DOH's reporting mechanisms to get research results out to the public.

### Larry Puchiarelli (DHS – Head Start)

**Overview of Program:** There are 7 Head Start Programs serving 2,700 children in the state of Rhode Island. All programs have some form of a family worker/social worker. Head Start

regulations require each family to have an assessment, though it does not specify that this has to occur through a home visit. However, teachers in Head Start must make two home visits a year to each student's home. Family workers deal with 30-50 families each year.

**Funding stream and amount:** Funding given to local programs by Department of Health and Human Services. Appropriated in budget by Congress

**Funding cycle/duration:** Ongoing

**Data currently collected:** Track referrals made and the outcome of those referrals. Home visit assessment form is different across all seven agencies (7 different forms).

**Challenges:** Workers need ongoing training, smaller ratios of families to workers. Some family workers are conducting home visits in shelters.

**Next Wishes:**

**Opportunities:** Work with the seven Head Start agencies to develop a standardized assessment tool for all home visits. Conduct trainings with family workers and teaching staff on healthy housing and visual assessment in homes.

### **Pam Hall (DCYF)**

**Overview of Program:** There are 1,400 in-home day cares in the state. Each home that is going to be licensed receives a home study and a fire inspection. The home must have smoke detectors, a landline phone, and two means of egress to be licensed, among other criteria. The provider is licensed for up to six children, eight if they have an assistant. New regulations are going to change a number of things: require that the provider has a GED/high school diploma and liability insurance, etc. DCYF makes home visits every two years unannounced. The fire inspector also inspects the home every two years.

**Funding stream and amount:** State budget appropriation

**Funding cycle/duration:** Ongoing; Annual state budget appropriation

**Data currently collected:** Detailed evaluation of the provider; less detailed assessment of the physical environment. Current questions include (in yes/no format):

- Size
- Safety of outdoor play area
- Heating system function
- Heating system safety
- Electrical outlets covered
- Firearm storage
- Pool safety
- Emergency evacuation plan
- Safe storage of drugs and medicines
- Stairways well lit and clear of obstruction
- Sufficient ventilation and lighting

- Paint and plaster is in good repair “not peeling or damage” in areas accessible to children
- The home is “maintained in good repair and in a clean, sanitary, hazard-free condition”
- Pets – kept in a safe and sanitary manner

Have an electronic system. Data from home assessments not all entered. Emergency contact data, address, provider name, activity notes, etc. are documented. DHS and DCYF are connected electronically to view information on the in-home day cares.

**Challenges:**

**Next Wishes:** Wish that they had more licensers so that DCYF could conduct more home visits, provide consultations to help people set up their programs and order toys and materials, etc.

**Opportunities:** “A-Z” training for all in-home day care providers. Opportunities to incorporate additional healthy homes questions into the assessment? Pam happy to provide any information or materials to the in-home day care provider population at any point.

**Ralph Groves (State Energy Office)**

**Overview of Program:** All CAP agencies run a weatherization program, a heating assistance program, an appliance management program, a boiler replacement program, and an energy conservation program.

- If a client qualifies for heating assistance they automatically apply for other programs
- Appliance management works to reduce electric use
- Boiler replacement – must be owner occupied houses
- Weatherization – elderly, disabled, and children are prioritized.

By federal law weatherization has to work on certain priorities:

1. Reducing air changes in the house
2. Insulation
3. Improving the efficiency of the heating system – tuning, heating, repairing

Always install a smoke and CO detector in the home.

For every dollar invested in weatherization, you get \$3.79 in return; \$1.30 is saved in conservation; Additional cost savings from lead safety, healthier housing.

**Funding stream and amount:** Federal funds from Health and Human Services (LIHEAP), Department of Energy; Also have demand side management funds from utilities - \$750,000 for weatherization and \$140,000 for heating system replacements; \$1 mil for appliance management program; \$200,000 from Providence Gas for natural gas customers. Funding is allocated to the seven CAP agencies in the state through a funding formula (poverty incidence, past delivery of program, etc.).

**Funding cycle/duration:** Funding allocated to the CAP agencies annually from the State Energy Office; CAP’s must spend 30% on material; State Energy Office tells the CAP agency how many homes they are to weatherize in a year.

**Data currently collected:** CAP agencies must report to the State Energy Office once a month on their weatherization programs and once a week on LIHEAP. Gather data on number of homes, average cost, number of elderly and children served. Applications to the programs and reporting forms are standardized across all agencies. Energy audits through the CAP agencies are standardized and electronically entered through PDA's.

**Challenges:** Windows are low on the priority list for energy conservation. By the time that the weatherization programs get through the top three federal priorities, they are generally out of money. Sometimes they are able to do a window in a child's bedroom under the health and safety funds. Waiting lists are long. In Providence it is 3 years, a year in other programs.

**Next Wishes:** If they could have an average cost of \$5,000 they would love to be able to replace all windows. Would also love to replace toilets – move from 4 gallon toilets to 1.4 gallon toilets; low flow showerheads. This would reduce the amount of water used tremendously, the amount of water that the tenant does not have to heat, and the amount of water the municipality has to clean.

**Opportunities:** Have demographic data on clientele served. May be opportunities for additional data collection at these points of contact. Ability to secure additional funding for window change outs or other health and safety improvements?

**Amy Rainone, Chris Gorham, Susan Boddington (RI Housing)**

**Overview of Program:** Run a number of programs ranging from below market interest-rate loans for homebuyers, Lead Hazard Reduction funds, supportive housing for the homeless, creating and preservation of low-income rental units among others. View the programs in the funding list below.

**Funding stream and amount:** Mixture of federal, state, and private dollars. Their mortgage program and the tax credits are the biggest funding streams.

\*\*\* The chart below was taken from RI Housing Annual Performance and Evaluation Report.

In PY 2005, a total of \$342,595,745 in Federal and State funding was made available to address affordable housing and community development needs, as shown below.

<b>Federal Resources</b>		
<b>Program</b>	<b>Administering Agency</b>	<b>Allocation</b>
Housing Choice Rental Vouchers (Section 8)	Rhode Island Housing	\$ 9,219,682
Section 202 Elderly	Direct to Recipients	\$5,807,000
Community Development Block Grant	Department of Administration	\$5,393,037
HOME Investment Partnership Program	Rhode Island Housing	\$5,350,039
Supportive Housing Program	Direct to Recipients/RI Housing	\$5,033,733
HUD Lead Hazard Reduction Program*	Rhode Island Housing	\$1,787,344
Section 811 Disabled	Direct to Recipients	\$2,801,600



Low Income Housing Tax Credits	Rhode Island Housing	\$3,091,210
HOPWA VI**	Rhode Island Housing	\$1,078,995
Shelter Plus Care***	Rhode Island Housing	\$580,109
HOPWA VII****	Rhode Island Housing	\$1,265,606
Emergency Shelter Grant Program	Department of Administration	\$329,150
HUD Housing Counseling Grants	Rhode Island Housing	\$96,718
*Total grant award over 36-month period from 10-1-04 to 9-30-07.		<b>\$41,834,223</b>
** PY from February 2005 to January 2006		
<b>TOTAL</b>		
*** PY from November 2004 to November 2005		
**** PY from December 14, 2004 to December 13, 2005		

<b>State of Rhode Island and Rhode Island Housing Resources</b>		
<b>Program</b>	<b>Administering Agent</b>	<b>Allocation</b>
Mortgage Revenue Bond Program	Rhode Island Housing	\$239,180,000
Rental Production Mortgages	Rhode Island Housing	\$29,456,846
Neighborhood Opportunities Program	Housing Resources Commission	\$9,596,083
Home Equity Conversion Mortgage	Rhode Island Housing	\$10,308,473
State Rental Assistance	Rhode Island Housing	\$4,037,468
State Lead Program*	Rhode Island Housing	\$1,536,759
Emergency Housing Assistance	RI Department of Human Services	\$1,081,348
Home Repair	Rhode Island Housing	\$609,000
Targeted Loan	Rhode Island Housing	\$2,494,602
Access Independence	Rhode Island Housing	\$161,791
Predevelopment Loan	Rhode Island Housing	\$278,220
Thresholds**	Rhode Island Housing	\$1,820,932
Targeted Assistance Grants ***	Rhode Island Housing	\$200,000
* Total grant award over 12-month period from 7-1-05 to 6-30-06. <b>TOTAL</b>		<b>\$300,761,522.00522</b>
** PY from 7-1-05 to 6-30-06		
*** PY from 7-1-05 to 6-30-06		

**Funding cycle/duration:** Varies by funding stream

**Data currently collected:** Demographic data on populations served, average costs per unit, number of units created or rehabbed. Because the standards for housing are so high, all units that RI Housing has data on are healthy and safe units. May be opportunities around units that are turned down from programs (section 8, etc.) due to poor condition

**Challenges:** Costs are increasing; privately developed units are cheaper to develop because they use a lower standard (Average cost \$200,000 to \$250,000 for both rehab and new construction). RI Housing has design standards that are above code, and provide for health and safety in the home.

**Next Wishes:** RI Housing does not have a clear-cut policy on healthy housing, and they are working to develop that by the end of the year. Want to have a consistent policy for their organization. Wants the bond issue to pass this fall, want improved supportive services, and

want to make the 5,000 units in 5-year goal. Wants to increase the number of 1<sup>st</sup> time homebuyers. Want to re-think the way the state is dealing with homelessness – eliminate emergency facilities and move to permanent supportive services.

**Opportunities:** If RI Housing is developing standards around healthy housing, the Healthy Housing Collaborative may be able to (a) be involved in that process and (b) help to disseminate/replicate those standards in other places so that all agencies involved in housing rehab/creation in the state are utilizing the same standards. RI Housing has access to management and property owners of subsidized units, as well as their tenants if we are interested in training/outreach.

### **Roger Warren (RI Builders Association)**

**Overview of Program:** Has 1,450 member organizations representing about 20,000 people. About ½ are builders/remodelers, the other ½ are subcontractors/suppliers. RIBA is a strictly volunteer organization. Members are in private residential construction. Provide benefits such as health insurance, workers comp, safety and education programs, OSHA training, and lobbying/advocacy. Some members work with non-profits to do affordable housing development, but almost all are private residential jobs.

**Funding stream and amount:** Funding from membership and programs for members.

**Funding cycle/duration:** Ongoing

**Data currently collected:** None that seem to relate to our goals.

**Challenges:** Dealing with many issues are air change. As building/design has helped to tighten up homes for energy efficiency, builders are struggling to provide proper air change and ventilation. Are working with the legislature to have mandatory licensing for contractors that will include skill based testing and continuing education.

**Next Wishes:** Assistance with the municipalities in getting permits. Additional units in cities and towns mean additional kids in the school systems, therefore new construction has decreased by 33% despite a time with historically low interest rates and high demand. This slows the market and keeps it from moving. Permit/cost issues make it difficult for members to promote certain regulations. For example, while most members agree that air changer systems would improve ventilation (and many already install them), they would fight against a mandated standard to install them as it's an added cost. Improved enforcement/penalties for unregistered contractors.

**Opportunities:** Was interested in more information about correlations between housing/environmental triggers and asthma. Would be interested in seeing more information about carpets, building materials, etc. Under the (hopefully) new licensure program, this could be a course for continuing education credit. Any opportunities through HRC to mobilize cities and towns to allow permits?

### **Steve O'Rourke (Providence Housing Authority and PHARI)**

**Overview of Program:** Steve's role in PHARI is to shepard the other housing authorities into a strategic planning process. In Providence Housing Authority (PHA) there are 2,607 units. Have two full time inspectors – must inspect units once a year, though they try to also do

preventive maintenance in all units as well. All inspectors have to go through a HUD inspector course. Residents have 2 orientations – one before they start living in the unit and an on-site orientation. Unit turnover rate was 426 units last year.

**Funding stream and amount:** Have a 40 million dollar consolidated budget, 50% of this is spend on Section 8 programs.

Three main funding streams:

- Rents from residents (set at 30% of net income)
- Performance funding subsidy – from HUD
- Interest income - charge rooftop space to cell phone companies, laundry and vending machines, etc.

Also apply for local, state, and federal grants. Currently have a HUD supportive services grant, family self-sufficiency grant, etc. that totals between \$1 mil and \$1.5 mil annually.

**Funding cycle/duration:** Annual renewal on subsidy from HUD; grants determined by varying cycles.

**Data currently collected:** Have tons of data on their units and residents! This is electronic and could potentially be shared. Have data on:

- Refusal rates
- Work orders by type
- Security issues
- Number of residents trained, GED scores, ESOL, etc.
- Average tenant rent
- Demographic information on all tenants

Need to see if the other PHA's also collect similar data and if it is electronic

**Challenges:** Vandalism, graffiti, working with tenants on doing their part to keep the housing units clean and trash out of the hallways. Have serious mold issues in certain buildings in some of their developments. Some has to do with building issues, also have issues with tenants having unvented dryers, boiling pots of water all day on the stove, etc.

**Next Wishes:** Major goal is to improve the image of public housing in Rhode Island. Working with the Governor to have “public housing week” and will be showcasing some of their nice developments in the state and providing fact sheets to legislators. If they had more funding they would work on “windshield appeal” working to improve public housing image issues in the state.

**Opportunities:** Can the Healthy Housing Collaborative help to improve the image of Public Housing? Will data from the FOP show better health outcomes in public housing vs. unaffordable, substandard housing? Resident service coordinators are required to meet with new residents within 30 days. Opportunities for tenant education and staff training. Steve asked for a training for their facilities/maintenance staff on how to identify and remediate mold. Also working on IPM in some of their units.

## **Sue Libutti (Comprehensive Child Care Services)**

**Overview of Program:** Program has been operating for six years. Have 4 networks that include 24 child care centers and 5 family providers. Children must be age eligible (3,4,5,) and income eligible (108% of poverty level). Staff teams include:

- Family advocate – provides home visit
- Health manager – health data (immunizations, EPSDT)
- Nutritionist – hemoglobin, height, weight
- Mental health – visits classroom once a month, refer families as needed
- Education manager – works with teacher
- Encourage home visits by teacher
- Program manager who hires all staff

Must provide at least one home visit a year.

**Funding stream and amount:** Funded by Feds through quality initiatives but streamlined through the RI Department of Human Services.

**Funding cycle/duration:** Annual, ongoing

**Data currently collected:** Track data on asthma, number of children served, lead screening, EBL's, immunizations, anemia, hearing/vision/dental screening, % over and under weight, etc. No specific housing assessment.

**Challenges:** There are issues around home visiting – resistance on both the teacher and family side. Language issues with refugee and immigrant populations. Family advocates are frustrated with housing issues and waiting lists for GED programs, etc.

**Next Wishes:** Mental health services are costly and are a big issues, would like to provide more of these services. Would like to expand the program to include infants/toddlers and/or to go to 125% of the poverty level.

**Opportunities:** Staff collaborates with Head Start on trainings – opportunities to provide training through the National Center for Healthy Housing? Sue offered to set up focus groups with the family advocates if we would like additional information.

## **Deb Archer (Cranston Head Start)**

**Overview of Program:** There are nine head start programs in Rhode Island. All have a home-based component. The programs are given a list of every child in their catchment area that is eligible for head start. The programs conduct recruitment home visits and mailings. Once children are enrolled in the program, teachers have to conduct at least 2 home visits annually with the family. The child's family advocate through the program must conduct 4 home visits annually. Cranston currently has 228 kids in their head start program and 20 kids in their early head start program. The program has 8 family advocates who cover about 38 families each. The advocates make sure families are up-to-date with needed services, develop asthma action plans, make referrals, etc.

**Funding stream and amount:** Funded by feds but streamlined through the RI Department of Human Services.

**Funding cycle/duration:** Annual, ongoing

**Data currently collected:** Track demographic information, track if referrals are made, and what the outcomes of those referrals were. During home visits they also ask about # of bedrooms, if the family lives with relatives, if housing is adequate, heating issues, etc. These data are reported in the "Program Information Report" at the end of the year to the federal government.

**Challenges:** Transportation is a huge issue both for families and the head start program itself. Many head start programs are cutting transportation for families entirely because it is too expensive (Providence, and East Bay have cut transportation, Cranston still has it but it is limited and there is no more room on buses). RIPTA does not offer cross-town bus lines so families have to go into the center of Providence and back out. With children, jobs, and responsibilities this takes too much time.

Other key issues are housing and heating assistance. Housing is impossible, especially in Cranston where there is nowhere affordable to live. Programs are not even taking names for wait lists at this point. Heating assistance, overcrowding, and utility shutoffs are also key challenges for the families they serve. The Program definitely has families that use space heaters/ovens for supplemental heat sources, and some families report moving to campgrounds in the summer months so that they don't have to pay utilities. They have about 10 to 20 families that deal with eviction each year, about 5 of those end up in shelters, while others double up with family members or move.

Nurses are seeing a rise in asthma and obesity in kids. Dental services are an issue, as very few dentists accept state funding for preventive dental services.

**Next Wishes:** To develop affordable, safe housing and more transportation for families (both to and from head start but also to groceries, medical appointments, etc.). Would like to see more housing that also provides supportive services (parenting education, budgeting, GED, job training).

**Opportunities:** Provide training for the family advocates in all Head Start Programs. Deb mentioned that her staff would like more information on their clients' rights, tenants' rights, etc. and that any services that they don't know about they are always glad to be informed of if they could benefit their families. The Program has a great connection with Cranston school department and work well with CCAP to provide other needed services.

# State Strategic Plan Assessment

## Summary of Overlapping Goals, Objectives, Opportunities

The strategies and recommendations presented below arose from an assessment of major Rhode Island Strategic Plans related to health, housing, or land use including:

- Rhode Island's Plan to Eliminate Childhood Lead Poisoning by 2010
- Rhode Island's Plan to End Homelessness
- Rhode Island's Five Year Strategic Housing Plan: 2006-2010
- Healthy Rhode Islanders 2010
- Land Use 2025

The goal of assessing these major strategic plans was to identify overlapping goals and objectives found within the plans and opportunities for partnership and collaboration.

### HEALTHY HOUSING GOALS

- Address problems of utility costs and shut-offs that deplete income for housing, cause people to lose housing, and keep them from becoming housed again (source: Plan to End Homelessness)
- Work with local utility companies to establish a program to encourage improvements to rental properties that increase energy efficiency, reducing housing costs (source: 5 Year Strategic Housing Plan)
- Reduce the proportion of persons exposed to air that does not meet the U.S. EPA's health-based standards for ozone:
  - Reduce residential energy demand through improvements in water heater designs and reduced hot water consumption (source: Healthy Rhode Islanders 2010)
- Increase energy efficiency through building design and location (source: Land Use 2025)
- Work with utility companies to reduce shut-offs, especially for vulnerable populations, to reduce poor health outcomes as a result of a lack of heat (space heater use, respiratory problems, "heat or eat" phenomenon, etc.)
- Incorporate LEEDS "green building" techniques in new construction and rehabilitation whenever possible (source: Land Use 2025)
- Develop specifications for a "healthy housing unit" for use by agencies conducting rehabilitation on Rhode Island's housing stock (source: Healthy Housing Collaborative –original draft vision statement and actions)
- Identify/research low-cost, healthy building methods to provide models for cities and towns to utilize in the implementation of their affordable housing plans.
- Reduce the cost of producing affordable housing (source: 5 Year Housing Plan)

## **ENFORCEMENT GOALS**

- Use code enforcement and other legal avenues to require abatement of lead in housing units (source: Healthy Rhode Islanders 2010)
- Support implementation and enforcement of the Lead Hazard Mitigation Law (source: RI Lead Poisoning Elimination Plan)
- Work with HRC to develop a strategy to respond to tenant complaints (source: RI Lead Poisoning Elimination Plan). Ensure these complaints are properly followed through with by code as necessary and other key agencies.
- Require the 29 communities to make progress toward their 10 percent goal as specified in the Affordable Housing Plans (source: 5 Year Strategic Housing Plan)
- Train the state's minimum housing code and building code officials on actions to take to improve the quality of Rhode Islanders' home environments (source: Healthy Housing Collaborative –original draft vision statement and actions)

## **DESIGN/HEALTHY LIFESTYLE GOALS**

- Reduce the proportion of children, adolescents, and adults who are overweight and obese (source: Healthy Rhode Islanders 2010)
- Create an interconnecting network of bike paths, trails, and walkways (source: Land Use 2025)
- Provide a diverse, well-balanced system of public outdoor recreation facilities (source: Land Use 2025)
- Promote mixed-use development
- Relate the location of residential developments and neighborhoods to employment and commercial centers, community facilities and services, and mass transit corridors (source: Land Use 2025)
- Require sidewalks in new development in all urban centers and neighborhoods (source: Land Use 2025)
- Discourage cul-de-sac street patterns in favor of interconnected streets that encourage walking (source: Land Use 2025)
- Create opportunities for employers to develop new housing or access housing for workers (source: 5 Year Strategic Housing Plan)
- Encourage new mixed-use development to be located near employment centers (source: 5 Year Strategic Housing Plan)

## **TECHNOLOGY/DATA GOALS**

- Develop and maintain excellent land use information and technology systems (GIS, centralized database for all aspects of land use) (source: Land Use 2025)
- Promote establishment of electronic data and mapping systems at the state and community level and the transfer of all pertinent land use information to electronic systems (source: Land Use 2025)
- Create a statewide housing database containing information about the quality of housing units and potential hazards in these units (source: Healthy Housing Collaborative –original draft vision statement and actions)
- Build on the public registry of high-risk properties for lead and look to expand this as a vehicle/model for other high-risk units (offshoot of Lead Elimination Plan goal)
- Develop a central Rhode Island Accessible Housing Registry that includes both public and private housing (source: Rhodes to Independence focus group recommendations)

## **SYSTEM GOALS**

- Seek private funds and partners such as Medicaid and Managed Care Organizations to reimburse for environmental interventions (source: Healthy Housing Collaborative –original draft vision statement and actions)
- Develop policy for the standardization of the definition of housing “accessibility” to be used throughout the housing system (source: 5 Year Housing Plan)
- Implement a home modification loan program for individuals with disabilities to provide loans to a homeowner who has a disability, etc. (source: 5 Year Housing Plan)
- Develop a central clearinghouse to coordinate resources and services for families of individuals with disabilities (sources: Rhodes to Independence focus group recommendations)
- Greatly expand the Emergency Housing Assistance Program (EHAP) (source: Plan to End Homelessness)
- Provide financing assistance to landlords to safely rehabilitate rental units that will be maintained affordable (source: 5 Year Housing Plan)
- Provide energy assistance for low-income households (source: 5 Year Housing Plan)
- Consider expanding financing assistance available to low-income property owners to address cited code violations (source: 5 Year Housing Plan)



## **Memorandum of Understanding Between the Rhode Island Department of Health and the Housing Resources Commission: January 2006**

WHEREAS, the Rhode Island Department of Health (HEALTH) is responsible for administering the Lead Poisoning Prevention Act, RIGL 23-24.6 and for protecting the public health and public interest by establishing a comprehensive program to reduce exposure to environmental lead and thereby prevent childhood lead poisoning;

WHEREAS, HEALTH is responsible for implementing Rhode Island's Plan to Eliminate Childhood Lead Poisoning by 2010;

WHEREAS, the Housing Resources Commission's (HRC) works to ensure that all Rhode Islanders have access to safe and affordable housing and is responsible for implementation of the Lead Hazard Mitigation Law, RIGL 42-128.1-5 and serves as the lead state agency for lead hazard mitigation, planning, education, technical assistance, and coordination of state projects and state financial assistance to property owners for lead hazard mitigation;

WHEREAS, HEALTH and the HRC both view access to safe, healthy, and affordable housing as a critical component to improving the lives of Rhode Island families and achieving the goals of both agencies;

HEALTH and HRC agree to enter into this Memorandum of Understanding to obtain necessary information that is for the mutual benefit of HEALTH and HRC thorough engaging in a collaborative effort to identify effective environmental health interventions at a statewide level across housing and health programs in the state, and for families in order to coordinate efforts to provide healthy, safe, and affordable housing to all Rhode Islanders. This MOU

### **CORE ACTIVITIES OF THE COLLABORATIVE**

HEALTH and the HRC perceive a critical need to make progress on the healthy housing issues described below by creating a HEALTH-HRC collaborative and having one individual lead this collaborative. HEALTH and HRC agree to participate in this collaborative as detailed below.

HEALTH agrees to:

- a. Provide **a portion** of one staff person's time (Ms. Ruth Lindberg) for the space of calendar year 2006, while Ms. Lindberg continues to be staff at the Childhood Lead Poisoning Prevention Program at the RI Department of Health and therefore reports to management of the Lead Program at HEALTH;
- b. Allow Ms. Lindberg to work on the coordination of this statewide effort as a liaison between HEALTH and the HRC;
- c. Provide leadership support to initiate partnerships and mobilize agencies as needed;
- d. Meet quarterly with leadership from the Housing Resources Commission to review progress and identify any necessary changes to this agreement.

The Housing Resources Commission agrees to:

- a. Work with Ms. Lindberg during calendar year 2006 as a liaison between HRC and HEALTH and provide leadership support from within the Commission to initiate partnerships and mobilize agencies as needed;
- b. Meet quarterly with leadership from HEALTH to review progress and identify any necessary changes to this agreement.
- c. Support, cooperate and facilitate Ms. Lindberg's work as it relates to this agreement as necessary.

- d. Coordinate with management of the Lead Program at HEALTH to ensure that Ms. Lindberg continues to fulfill her responsibilities within HEALTH and to mutually agree on priorities for her work.

Activities to be performed and delivered by Ms. Lindberg as a liaison between HEALTH and HRC, and mutually agreed upon by both agencies are listed below.

- a. Continue to staff the Childhood Lead Poisoning Prevention Program and collaborate with other local groups and/or efforts that may have an impact in matters related to healthy housing in Rhode Island, and facilitate the interaction and common goal setting among and between all parties;
- b. Continue to convene the "Healthy Housing Collaborative" established in July, 2005 and utilize this group as an advisory board;
- c. Develop a vision statement for "healthy housing" in Rhode Island with input from the Healthy Housing Collaborative;
- d. Conduct a thorough literature review, and prepare a report, on:
  - The impacts of unhealthy housing on child health and development;
  - Benefits for child health and development associated with improved housing maintenance and building practices;
  - Cost-benefit analysis for healthy housing building and maintenance practices.
- e. Conduct an assessment of existing state resources (financial and staff) currently allocated to healthy housing, complete this assessment and present it in the form of a final report;
- f. Conduct an assessment of major strategic plans in the state (Rhode Island's Plan to Eliminate Childhood Lead Poisoning, Rhode Island's Plan to End Homelessness, Rhode Island's Five Year State Strategic Plan, and the city and town affordable housing plans mandated by the Low and Moderate Income Housing Act) to identify overlapping goals and opportunities for partnership and collaboration;

In the process of completing the above activities, an effort will be made to also lay the groundwork and take some initial planning steps to develop the following:

- f. Develop a research strategy that could be utilized to fill in gaps in research at the local and/or national level in conjunction with funding sources such as local Universities;
- g. Conduct a SWOT analysis (strengths, weaknesses, opportunities, and threats) for the state of Rhode Island in relation to healthy housing objectives;
- h. Develop a Request for Proposals (RFP) to mobilize the state's vision for a statewide housing database.

## **II. PERIOD OF AGREEMENT AND TERMINATION**

The period of this agreement shall commence on January 17<sup>th</sup> 2006 and remain in full force and effect until December 31<sup>st</sup>, 2006, at which time the parties can reassess the needs and may jointly decide to extend the agreement period as needed.

Either party can terminate this agreement if Ms. Lindberg's employment with the Department of Health ends, or when there is a substantial breach of the obligations described herein by the either agency, or with thirty (30) days advance notice of a cancellation for any reason.

## **III. AGREEMENT MODIFICATIONS**

This agreement may be amended and/or extended at any time by mutual written consent to more accurately reflect changes in policies, procedures, timeframes, or other reasonable circumstances.

In witness whereof, both the Rhode Island Department of Health and the Housing Resources Commission, through their duly authorized representatives, have hereunto executed this Agreement as of the last date below written.

\_\_\_\_\_  
Magaly Angeloni  
Manager, RI Childhood Lead Poisoning Prevention Program

Date: \_\_\_\_\_

\_\_\_\_\_  
Noreen Shawcross  
Executive Director, Housing Resources Commission

Date: \_\_\_\_\_

## **Memorandum of Understanding between the Rhode Island Department of Health and the Rhode Island Housing Resources Commission: January 2007**

WHEREAS, the Rhode Island Department of Health (HEALTH) is responsible for administering the Lead Poisoning Prevention Act, RIGL 23-24.6 and for protecting the public health and public interest by establishing a comprehensive program to reduce exposure to environmental lead and thereby prevent childhood lead poisoning;

WHEREAS, HEALTH is responsible for implementing Rhode Island's Plan to Eliminate Childhood Lead Poisoning by 2010;

WHEREAS, the Housing Resources Commission's (HRC) works to ensure that all Rhode Islanders have access to safe and affordable housing and is responsible for implementation of the Lead Hazard Mitigation Law, RIGL 42-128.1-5 and serves as the lead state agency for lead hazard mitigation, planning, education, technical assistance, and coordination of state projects and state financial assistance to property owners for lead hazard mitigation;

WHEREAS, HEALTH and the HRC both view access to safe, healthy, and affordable housing as a critical component to improving the lives of Rhode Island families and achieving the goals of both agencies;

HEALTH and HRC agree to enter into this Memorandum of Understanding to work on collaborative efforts that are for the mutual benefit of HEALTH and HRC and that will promote efforts at a statewide level to provide healthy, safe, and affordable housing to all Rhode Islanders.

### **I. CORE ACTIVITIES OF THE COLLABORATIVE**

HEALTH and the HRC perceive a critical need to make progress on the healthy housing issues described below by creating a HEALTH-HRC collaborative. HEALTH and HRC agree to participate in this collaborative as detailed below.

HEALTH agrees to:

- e. Provide HRC support in the form of staff time (primarily Melissa Barie's time, but it could also include time from other staff from the Lead Program, as applicable) for the space of calendar year 2007, while Melissa continues to be staff at the Childhood Lead Poisoning Prevention Program at the RI Department of Health and therefore reports to management of the Lead Program at HEALTH;
- f. Allow Melissa Barie to work on the coordination of this statewide effort as a liaison between HEALTH and the HRC;
- g. Provide leadership support to initiate partnerships and mobilize agencies as needed;
- h. Meet quarterly with leadership from the Housing Resources Commission to review progress and identify any necessary changes to this agreement;
- i. Keep HRC informed of progress on ongoing activities including, but not limited to: efforts with the Providence Plan to collect CAMA data from cities and towns in RI; research ideas generated through the Brown University/HEALTH collaboration; and progress on RI's Plan to Eliminate Childhood Lead Poisoning by 2010.

The Housing Resources Commission agrees to:

- e. Work with Melissa Barie (and other staff from the Lead Program at the Department of Health, as applicable) during calendar year 2007 as a liaison between HRC and HEALTH and provide leadership support from within the Commission to initiate partnerships and mobilize agencies as needed;
- f. Meet quarterly with leadership from HEALTH to review progress and identify any necessary changes to this agreement.
- g. Support, cooperate and facilitate Melissa's work as it relates to this agreement as necessary.
- h. Coordinate with management of the Lead Program at HEALTH to ensure that Melissa Barie continues to fulfill her responsibilities within HEALTH and to mutually agree on priorities for her work;
- i. Keep HEALTH informed of progress on ongoing activities including, but not limited to: the Neighborhood Opportunities Program (NOP)/Building Homes Rhode Island (Affordable Housing Bond) homes produced that are lead-safe and/or energy efficient; the "Safe Routes to Schools" project; Land Use 2025 and the State Strategic Housing Plan implementation progress; home modifications made for individuals with disabilities through Community Development Block Grant (CDBG) funds; updates to the City/Town Resource guide to include "healthy housing" resources; the development of performance measures for the 5 Year Strategic Housing Plan; and data collection through the HRC or any office of the Division of Planning related to housing,

Activities to be performed and delivered by Melissa Barie as a liaison between HEALTH and HRC, and mutually agreed upon by both agencies are listed below. These activities will be completed by December 31, 2007. A timeline will be prepared by the end of January 2007 to provide an estimated schedule of the deliverables.

- g. Continue to staff the Childhood Lead Poisoning Prevention Program and collaborate with other local groups and/or efforts that are directed to achieve the statewide vision of healthy housing as proposed and accepted by the Healthy Housing Collaborative,
- h. Continue to convene the "Healthy Housing Collaborative" established in July 2005 and utilize this group as an advisory board to keep the group informed and receive ongoing feedback with regards to the activities that are part of this agreement. Carry out activities to implement the recommendations formulated in the principle document of the Healthy Housing Collaborative, "Healthy Housing: Why Rhode Island Should Invest in the Vision."
- i. Prepare a fact sheet with the recommended materials and methods that can be used for low-cost, healthy building methods to provide models that key groups can utilize in their decisions to purchase/use building materials. This will include, but is not limited to, information on materials/methods that provide:
  - "Cleanable" and low VOC (volatile organic compounds) flooring choices
  - Improved ventilation
  - Energy efficiency

Preparation of this fact sheet implies working with a number of parties, research the cost, best practices, needs, policies that entities must observe and work with those entities to try to reach consensus and usability of the fact sheet. The fact sheet or educational material will be disseminated to the RI Builder's Association, the 39 cities and towns, the Public Housing Authorities, the Community Development Corporations, non-profit developers, and others.

- j. Work with key agencies such as Rhode Island Housing to develop basic specifications for a "healthy housing unit" that could be disseminated to groups creating and

rehabilitating housing units in the state. The specifications will provide a basic guide for any group or agency conducting repairs or building housing in Rhode Island. They will cover basic construction/rehabilitation standards that contractors and agencies can implement in their daily work, and will also contain the recommendations of building materials/methods identified through activity c., above, as well as ongoing maintenance.

- k. Identify key agencies and officials in need of training on healthy housing and in-home visual assessment. Coordinate training for groups including, but not limited to, Head Start teachers and family workers, the Public Housing Authorities, and the state's minimum housing code and building code officials.
- l. Share the results of the Harvard School of Public Health's study that will be available in January 2007 with the Healthy Housing Collaborative and continue to work with the Collaborative and HEALTH's Asthma Control Program to identify funds for and pilot the efficacy of environmental interventions for children with asthma through "Asthma Centers."
- m. Identify an effective mean to inform legislators, cities and towns, and the general public about health impacts from unhealthy housing, make that information more public and accessible and work on one publication on the topic during 2007.
- n. Prepare a year-end report for 2007 utilizing Rhode Island's Legislative Tracking System to monitor any bills put before the legislature that would improve or hinder efforts toward healthy housing, utility shut-off prevention and identify any model tools or incentives that could be utilized in long-term legislative efforts in RI. This summary report should also include updates on efforts with other entities like the George Wiley Center (as it relates to shut-offs) and the National Center for Healthy Housing to track the progress of federal legislation that is introduced in 2007. The report should be shared and discussed with the Healthy Housing Collaborative and other groups as an update on the most recent federal legislative initiatives.

In the process of completing the above activities, HEALTH and the HRC also agree to work jointly to initiate and/or develop activities for the following:

- o. Continue to take steps toward the development of a statewide housing database containing information about the quality and accessibility of housing, building permits, code enforcement efforts, etc.;
- p. Assist in initial planning of a joint "healthy housing" report from HEALTH and HRC in 2008;
- q. Collaborate on improved code enforcement strategies, including increased training, in local cities and towns.
- r. Work with DCYF to change the policy of licensing home-based day cares to require improved housing quality assessments.
- s. Work with Head Start agencies to assess the feasibility to develop a standardized assessment tool for all home visits.
- t. Assess the feasibility of utilizing KIDSNET to identify high-risk newborns and children through the WIC program and the Level 1 screening data to formulate an outreach strategy to provide Lead Hazard Mitigation Law and healthy housing information to these populations.
- u. Continue the partnership to recruit hardware stores into the Keep it Clean campaign, and work to encourage all hardware stores to post the HRC Warning Sign to promote the use of lead-safe work practices.
- v. Continue to work on the development and implementation of the "Landlord and Tenant Handbook"

## **II. PERIOD OF AGREEMENT AND TERMINATION**

The period of this agreement shall commence on January 2nd, 2007 and remain in full force and effect until December 31<sup>st</sup>, 2007, at which time the parties can reassess the needs and may jointly decide to extend the agreement period as needed.

Either party can terminate this agreement if MELISSA BARIE'S employment with the Department of Health ends, or when there is a substantial breach of the obligations described herein by the either agency, or with thirty (30) days advance notice of a cancellation for any reason.

## **III. AGREEMENT MODIFICATIONS**

This agreement may be amended and/or extended at any time by mutual written consent to more accurately reflect changes in policies, procedures, timeframes, or other reasonable circumstances.

In witness whereof, both the Rhode Island Department of Health and the Housing Resources Commission, through their duly authorized representatives, have hereunto executed this Agreement as of the last date below written.

\_\_\_\_\_  
Magaly C. Angeloni  
Manager, RI Childhood Lead Poisoning Prevention Program

Date: \_\_\_January 2007\_\_\_

\_\_\_\_\_  
Noreen Shawcross  
Executive Director, RI Housing Resources Commission

Date: \_\_\_January 2007\_\_\_

## **RI Healthy Housing Collaborative Members**

<b>First Name</b>	<b>Last Name</b>	<b>Organization</b>
Linda	Bradley	Ocean State Center for Independent Living
Chris	Camillo	Hasbro Children's Hospital
Brenda	Clement	Housing Network of RI
Laura	Cote	Hasbro Children's Hospital
Doris	DeLosSantos	Housing Resources Commission
Riana	Good	Childhood Lead Action Project
Chris	Gorham	RI Housing
Ralph	Groves	State Energy Office
Simon	Kue	Housing Resources Commission
Melissa	Barie	RI Department of Health
Alex	Moore	RI HUD Tenant Project
Dawn	Nardi	One RI
Leigh	Pagnozzi	RI Coalition for the Homeless
Arthur	Plitt	Governor's Commission on Disabilities
Amy	Rainone	RI Housing
Dawn	Rogers	Westbay CAP
Jessica	Rutledge	Statewide Housing Action Coalition
Noreen	Shawcross	Office of Housing and Community Development
Peter	Simon	RI Department of Health
Derek	Winslow	Clearcorps Providence



## SECTION VI. REFERENCES

1. AAP. Noise: A Hazard for the Fetus and Newborn. *Pediatrics* 1997;100(4):724-7.
2. Aschengrau A, Hardy S, Mackey P and Pultinas D. The Impact of Low Technology Lead Hazard Reduction Activities among Children with Mildly Elevated Blood Lead Levels, *Environmental Research* 1998/10;79(1):41-50.
3. Brown, Mary Jean et. al. A Randomized, Community-Based Trial of Home Visiting to Reduce Blood Lead Levels in Children. *Pediatrics* Volume 117, number 1, January 2006, p. 147.
4. Carter MC, Perzanowski MS, Raymond A and Platts-Mills TA. Home intervention in the treatment of asthma among inner-city children. *J Allergy Clin Immunol* 2001;108(5):732-7.
5. Center for Housing Policy. America's Newest Working Families: Cost, Crowding and Conditions for Immigrants. July 2003.
6. Committee of the Environmental and Occupational Health Assembly, American Thoracic Society. Health effects of outdoor air pollution. *Am J Respir Crit Care Med* 1996; 153: 3-50, 477-98.
7. Council on Scientific Affairs. Preventing death and injury from fires with automatic sprinklers and smoke detectors. *JAMA* 257: 1618-1620, 1987.
8. Dietrich, K.N. et al. Early exposure to lead and juvenile delinquency. *Neurotoxicology and Teratology* 2001; 23 (6): 511-518.
9. Dockrell J, Shield. Children's perceptions of their acoustic environment at school and at home. *The Journal of the Acoustical Society of America* 2004;115(6):2964-73.
10. Eggleston PA 2000. Environmental causes of asthma in inner city children. The National Cooperative Inner City Asthma Study. *Clin Rev Allergy Immunol* 18:311-324.
11. EPA. Training and Certification Program for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities. 2005.
12. EPA. Lead in Paint, Dust, and Soil. 2006(4/10/06).
13. Ettinger, Adrienne S Bornschein, Robert L Farfel, Mark Campbell, Carla Ragan, N Beth Rhoads, George G Brophy, Merrill Wilkens, Sherry Dockery, Douglas W. Assessment of cleaning to control lead dust in homes of children with moderate lead poisoning: treatment of lead-exposed children trial. *Environmental health perspectives* 2002;110(12):A773.
14. Evans GW. Child development and the physical environment. *Annual Review Of Psychology* 2006;57:423-51.
15. Evans GW, Gonnella C, Marcynyszyn LA, Gentile L and Salpekar N. The Role of Chaos in Poverty and Children's Socioemotional Adjustment. *Psychological Science* 2005;16(7):560-5.
16. Fergusson, David M Grant, Hildegard Horwood, L John Ridder, Elizabeth M. Randomized trial of the Early Start program of home visitation. *Pediatrics* 2005;116(6):e803.
17. Finkelstein et. al. National medical spending attributable to overweight and obesity: how much, and who is paying? *Health Affairs* 2003; W3:219-26
18. Folmer, Robert L Griest, Susan E Martin, William Hal. Hearing conservation education programs for children: a review. *The Journal of school health* 2002;72(2):51.
19. Friedman et al. Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *JAMA* 285 (7): 897-905, 2001.
20. Gary WE, Peter L, Markus M, Hartmut I and Walter WK. Community noise exposure and stress in children. *The Journal of the Acoustical Society of America* 2001;109(3):1023-7.
21. Gergen PJ, Mortimer KM and Eggleston PA, et al. Results of the National Cooperative Inner-City Asthma Study (NCICAS) environmental intervention to reduce cockroach allergen exposure in inner-city homes. *J Allergy Clin Immunol* 1999;103(3 Pt 1):501-6.
22. Gielen, Andrea Carlson McDonald, Eileen M Wilson, Modena E H Hwang, Wei-Ting Serwint, Janet R Andrews, John S Wang, Mei-Cheng. Effects of improved access to safety counseling, products, and home visits on parents' safety practices: results of a randomized trial. *Archives of pediatrics adolescent medicine* 2002;156(1):33.
23. Haynes, Erin Lanphear, Bruce P Tohn, Ellen Farr, Nick Rhoads, George G. The effect of interior lead hazard controls on children's blood lead concentrations: a systematic evaluation. *Environmental health perspectives* 2002;110(1):103.
24. Hendrickson SG. Reaching an underserved population with a randomly assigned home safety intervention. *Inj Prev* 2005;11(5):313-7.

25. Hodnett, E D Roberts,I. Home-based social support for socially disadvantaged mothers. The Cochrane database of systematic reviews 2000;(2):CD000107.
26. Horowitz et. al. Barriers to buying healthy foods for people with diabetes: evidence of environmental disparities. *Am J Public Health* 2004; 94-1549-54
27. HUD. Healthy Homes and Lead Hazard Control. 2005;2006(4/10).
28. HUD. National Survey of Lead and Allergens in Housing Volume I: Analysis of Lead Hazards. Westat, Inc., 2002.
29. Inagami et al. You are where you shop: Grocery store locations, weight, and neighborhoods. *Am J Prev Med* 2006; 31 (1).
30. Jaakkola JJ et. al. Interior surface materials in the homes....development of bronchial obstruct. *Am J Public Health* 1999 188-192.
31. Kattan M, Stearns SC and Crain EF, et al. Cost-effectiveness of a home-based environmental intervention for inner-city children with asthma. *J Allergy Clin Immunol* 2005;116(5):1058-63.
32. Kennedy D, Bates RR, editors. Air pollution, the automobile and public health. Washington DC: National Academy Press; 1989.
33. King, W J Klassen, T P LeBlanc, J Bernard-Bonnin, A C Robitaille, Y Pham, B Coyle, D Tenenbein, M Pless,I B. The effectiveness of a home visit to prevent childhood injury. *Pediatrics* 2001;108(2):382.
34. King WJ, LeBlanc JC and Barrowman NJ, et al. Long term effects of a home visit to prevent childhood injury: three year follow up of a randomized trial. *Inj Prev* 2005;11(2):106-9.
35. Klinnert MD, Liu AH, Pearson MR, Ellison MC, Budhiraja N and Robinson JL. Short-term impact of a randomized multifaceted intervention for wheezing infants in low-income families. *Arch Pediatr Adolesc Med* 2005;159(1):75-82.
36. Knoblock MJ, Broste SK. A Hearing Conservation Program for Wisconsin Youth Working in Agriculture. *Journal of School Health* 1998;68(8):313.
37. Krieger J, Higgins DL. Housing and health: time again for public health action. *Am J Public Health* 2002;92(5):758-68.
38. Krieger JK, Takaro TK and Allen C, et al. The Seattle-King County healthy homes project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma. *Environ Health Perspect* 2002;110 Suppl 2:311-22.
39. Krieger JW, Takaro TK, Song L and Weaver M. The Seattle-King County Healthy Homes Project: a randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *Am J Public Health* 2005;95(4):652-9.
40. Lanphear, B P Eberly, S Howard,C R. Long-term effect of dust control on blood lead concentrations. *Pediatrics* 2000;106(4):E48.
41. Lanphear, B P Howard, C Eberly, S Auinger, P Kolassa, J Weitzman, M Schaffer, S J Alexander,K. Primary prevention of childhood lead exposure: A randomized trial of dust control. *Pediatrics* 1999;103(4 Pt 1):772.
42. Lanphear BP, Winter NL. A randomized trial of the effect of dust control on children's blood lead levels. *Pediatrics* 1996;98(1):35.
43. Leighton, Jessica Klitzman, Susan Sedlar, Slavenka Matte, Thomas Cohen,Neal L. The effect of lead-based paint hazard remediation on blood lead levels of lead poisoned children in New York City. *Environmental research* 2003;92(3):182.
44. Lercher P, Evans GW, Meis M and Kofler WW. Ambient neighbourhood noise and children's mental health. *Occup Environ Med* 2002;59(6):380-6.
45. Liyo, P J Yiin, L M Adgate, J Weisel, C Rhoads,G G. The effectiveness of a home cleaning intervention strategy in reducing potential dust and lead exposures. *Journal of exposure analysis and environmental epidemiology* 1998;8(1):17.
46. Mallonee S. Evaluating injury prevention programs: the Oklahoma City Smoke Alarm Project. *The future of children* 2000;10(1):164.
47. McConnell R, Milam J and Richardson J, et al. Educational intervention to control cockroach allergen exposure in the homes of hispanic children in Los Angeles: results of the La Casa study. *Clin Exp Allergy* 2005;35(4):426-33.
48. McDonald EM, Solomon B and Shields W, et al. Evaluation of kiosk-based tailoring to promote household safety behaviors in an urban pediatric primary care practice. *Patient Educ Couns* 2005;58(2):168-81.

49. Morgan WJ, Crain EF and Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma. *N Engl J Med* 2004;351(11):1068-80.
50. Mushak P. Lead remediation and changes in human lead exposure: some physiological and biokinetic dimensions. *The Science of The Total Environment* 2003/2/15;303(1-2):35-50.
51. Mushak P. Lead remediation and changes in human lead exposure: some physiological and biokinetic dimensions. *The Science of The Total Environment* 2003/2/15;303(1-2):35-50.
52. National Academy of Sciences. Committee on Developmental Toxicology. *Scientific Frontiers in Developmental Toxicology and Risk Assessment*. Washington, DC: National Academy Press, 2000.
53. National Environmental Trust, Physicians for Social Responsibility, and Learning Disabilities Association of America. *Polluting our future: Chemical pollution in the U.S. that affects child development and learning*. September 2000. [www.safekidsinfo.org](http://www.safekidsinfo.org)
54. Platt-Mills TA, Sporik RB, Chapman MD and Heymann PW. The role of indoor allergens in asthma. *Allergy* 1995;50(22 Suppl):5-12.
55. Porsbjerg C, von Linstow ML, Ulrik CS, Nepper-Christensen S and Backer V. Risk factors for onset of asthma: a 12-year prospective follow-up study. *Chest* 2006;129(2):309-16.
56. Randolph, Robert F Hudak, Roberta L Vaught, Charles. Communicating hearing loss information to young children effectiveness of lecture and printed materials. *AAOHN journal* 2003;51(10):433.
57. Rhoads, G G Ettinger, A S Weisel, C P Buckley, T J Goldman, K D Adgate, J Lioy, P J. The effect of dust lead control on blood lead in toddlers: a randomized trial. *Pediatrics* 1999;103(3):551.
58. Rhodes to Independence 2005 Annual Report
59. Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
60. Rhodes to Independence Housing Focus Group Report.
61. Richardson G, Eick S and Jones R. How is the indoor environment related to asthma?: literature review. *J Adv Nurs* 2005;52(3):328-39.
62. Roberts, I Kramer, M S Suissa, S. Does home visiting prevent childhood injury? A systematic review of randomised controlled trials. *BMJ* 1996;312(7022):29.
63. Roberts JW, Dickey P. Exposure of children to pollutants in house dust and indoor air. *Rev Environ Contam Toxicol*. 1995; 143:59-78
64. Rosenstreich DL et. al. The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. *J Allergy Clin Immunol*. 2000; 106: 1075-1080.
65. Runyan et al. Risk factors for fatal residential fires. *N England Journal of Medicine* 327: 859-863, 1992
66. Sandel, Megan et al. *Housing Interventions and Child Health: A Critical Review*. July 2004
67. Schober, Susan et al. Blood Lead Levels and Death from all causes, cardiovascular disease, and cancer: Results from the NHANES III Mortality Study. *Environmental Health Perspectives* 114: 1538-1541 (2006).
68. Stansfeld SA, Berglund B and Clark C, et al. Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet* 2005;365(9475):1942.
69. Szpir, Michael. *Environmental Health Perspectives: Focus*. Vol. 114; 2. February 2006.
70. Taha T, Kanarek MS, Schultz BD and Murphy A. Low-Cost Household Paint Abatement to Reduce Children's Blood Lead Levels, *Environmental Research* 1999/11;81(4):334-8.
71. Takaro TK, Krieger JW and Song L. Effect of environmental interventions to reduce exposure to asthma triggers in homes of low-income children in Seattle. *J Expo Anal Environ Epidemiol* 2004;14 Suppl 1:S133-43.
72. Trapanotto M, Benini F, Farina M, Gobber D, Magnavita V and Zacchello F. Behavioural and physiological reactivity to noise in the newborn. *Journal of Paediatrics & Child Health* 2004;40(5/6):275.
73. Turner et al. *Distressed Public Housing – What it costs to do nothing*. The Urban Institute, April 2005.
74. Wernette DR et al. Breathing polluted air: Minorities are disproportionately exposed. *EPA Journal* 1992; 18:16-17.
75. Wilson SR, Yamada EG and Sudhakar R, et al. A controlled trial of an environmental tobacco smoke reduction intervention in low-income children with asthma. *Chest* 2001;120(5):1709-22.

76. Wind S, Van Sickle D and Wright AL. Health, place and childhood asthma in southwest Alaska. *Soc Sci Med* 2004;58(1):75-88.
77. Zenk et. al. Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med* 2002; 22:23-9.

## SECTION VII. ENDNOTES

- 
- <sup>1</sup> National Center for Healthy Housing, Essentials of Healthy Homes Practitioners Course Student Manual.
- <sup>2</sup> World Health Organization, Review of Evidence on Housing and Health: Background Document, April 28, 2004.
- <sup>3</sup> The signed declaration, Fourth Ministerial Conference on Environment and Health, Budapest Hungary, 23-25 June 2004.
- <sup>4</sup> Shaw, M. Housing and Public Health. Annual Reviews of Public Health 25:8.1-8.22 (2004)
- <sup>5</sup> Commission for Environmental Cooperation. Children's Health and the Environment in North America. 2006
- <sup>6</sup> Porsbjerg C et al. Risk factors for onset of asthma: a 12-year prospective follow-up study. Chest 2006; 129 (2): 309-16.
- <sup>7</sup> Rosenstreich DL et. al. The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. J Allergy Clin Immunol. 2000; 106: 1075-1080
- <sup>8</sup> Jaakkola JJ et. al. Interior surface materials in the home and the development of bronchial obstruction. Am J Public Health 1999 188-192.
- <sup>9</sup> Roberts JW, Dickey P. Exposure of children to pollutants in house dust and indoor air. Rev Environ Contam Toxicol. 1995; 143:59-78
- <sup>10</sup> Childhood asthma: an overview (2005). New York, NY: American Lung Association. [www.lungusa.org](http://www.lungusa.org)
- <sup>11</sup> Lanpher et al. Residential exposure associated with asthma in US children. Pediatrics. 2001; 107; 505-511.
- <sup>12</sup> Centers for Disease Control and Prevention. Use of Unvented Residential Heating Appliances, United States, 1988-1994. MMWR, 46(51): 1221-1224.
- <sup>13</sup> Dey AN, Schiller JS, Tai DA. Summary health statistics for U.S. children: National health interview survey, 2002. National Center for Health Statistics. Vital Health Stat 10 (221). 2004.
- <sup>14</sup> RI BRFSS 2002
- <sup>15</sup> Dey AN, Schiller JS, Tai DA. Summary health statistics for U.S. children: National health interview survey, 2002. National Center for Health Statistics. Vital Health Stat 10 (221). 2004.
- <sup>16</sup> RI BRFSS 2002
- <sup>17</sup> Rhode Island Department of Health, 2000-2004 data.
- <sup>18</sup> J Allergy Clin Immuno 2002 Feb; 109 (2): 264-70
- <sup>19</sup> MMWR, Surveillance for Asthma, US CDC 2002.
- <sup>20</sup> Eggleston PA 2000. Environmental causes of asthma in inner city children. The National Cooperative Inner City Asthma Study. Clin Rev Allergy Immunol 18:311-324
- <sup>21</sup> Sandel, Megan et al. Housing Interventions and Child Health: A Critical Review. July 2004
- <sup>22</sup> Watson et al. The Canadian Asthma Primary Prevention Study: Outcomes at 2 years of age. J Allergy Clin Immunology. 2004; 113: 650-656.
- <sup>23</sup> Kattan, Meyer et al. Journal of allergy and clinical immunology 2004; 116: 1058-1063
- <sup>24</sup> Centers for Disease Control and Prevention. "Preventing Lead Poisoning in Young Children." October 1991.
- <sup>25</sup> Centers for Disease Control and Prevention. "Screening Young Children for Lead Poisoning." November 1997.
- <sup>26</sup> Centers for Disease Control and Prevention. "Preventing Lead Poisoning in Young Children." October 1991.
- <sup>27</sup> Mushak, P et al. Prenatal and postnatal effects of low-level lead exposure." Environmental Research 1989; 50: 11-36.
- <sup>28</sup> Schwartz, J et al. Relationship between childhood blood lead levels and stature. 1986; 77: 281-288.
- <sup>29</sup> Shukla, Rakesh et al. Fetal and infant lead exposure: effects on growth in stature. Pediatrics 1989;84:604-612.
- <sup>30</sup> Schwarta, J and Otto, D. Blood lead, hearing thresholds, and neurobehavioral development in children and youth. Archives of Environmental Health 1987: 42: 153-160.

- 
- <sup>31</sup> Schwarta, J and Otto, D. Blood lead, hearing thresholds, and neurobehavioral development in children and youth. *Archives of Environmental Health* 1987; 42: 153-160.
- <sup>32</sup> Bellinger et al. Low-level lead exposure and children's cognitive function in the preschool years. *Pediatrics* 1991; 87: 219-227.
- <sup>33</sup> Needleman, H and C. Gatsonis. Low-level lead exposure and the IQ of children. *JAMA* 1990 ; 263:673-678.
- <sup>34</sup> Schober, Susan et al. Blood Lead Levels and Death from all causes, cardiovascular disease, and cancer: Results from the NHANES III Mortality Study. *Environmental Health Perspectives* 114: 1538-1541 (2006).
- <sup>35</sup> Dietrich, K.N. et al. Early exposure to lead and juvenile delinquency. *Neurotoxicology and Teratology* 2001; 23 (6): 511-518.
- <sup>36</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>37</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>38</sup> HUD. *Healthy Homes and Lead Hazard Control. 2005; 2006 (4/10).*
- <sup>39</sup> EPA. *Training and Certification Program for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities. 2005.*
- <sup>40</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>41</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>42</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>43</sup> Rhode Island Department of Health. *Childhood Lead Poisoning in Rhode Island: The Numbers 2006 Edition.*
- <sup>44</sup> HUD. *National Survey of Lead and Allergens in Housing Volume I: Analysis of Lead Hazards. Westat, Inc. 2002.*
- <sup>45</sup> *Comprehensive Strategic Plan, Lead Hazard Mitigation Act of 2002, prepared by the Housing Resources Commission*
- <sup>46</sup> Ettinger, A et al. Assessment of cleaning to control lead dust in homes of children with moderate lead poisoning: treatment of lead-exposed children trial. *Environmental Health Perspectives* 2002; 110 (12): A773.
- <sup>47</sup> Dixon et al. Effectiveness of lead-hazard control interventions on dust lead loadings: Findings from the evaluation of the HUD Lead-Based Paint Hazard Control Grant Program.
- <sup>48</sup> Mushak P. Lead remediation and changes in human lead exposure: some physiological and biokinetic dimensions. *The Science of the Total Environment* 2003; 303 (1-2): 35-50.
- <sup>49</sup> EPA. *Training and Certification Program for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities. 2005.*
- <sup>50</sup> Brown, Mary Jean et. al. A Randomized, Community-Based Trial of Home Visiting to Reduce Blood Lead Levels in Children. *Pediatrics* Volume 117, number 1, January 2006, p. 147
- <sup>51</sup> American Association of Poison Control Centers, cited by the National Center for Healthy Housing.
- <sup>52</sup> Koriath, Trisha. Rodent pets and pest linked to developmental defects in fetuses. *AAP News* January 2006.
- <sup>53</sup> Centers for Disease Control and Prevention. *Managing Rodents and Mosquitoes through Integrated Pest Management. Webcast.*
- <sup>54</sup> Hirschhorn, R.B. and Hodge, R.R. Identification of risk factors in rat bite incidents involving humans. *Pediatrics* 1999; 104 (3): e35.
- <sup>55</sup> Centers for Disease Control and Prevention. *Managing Rodents and Mosquitoes through Integrated Pest Management. Webcast.*
- <sup>56</sup> US EPA Office of Indoor Air Quality. *Sources of Indoor Air Pollution – Pesticides.*
- <sup>57</sup> Schettler et al. In *Harm's way: Toxic threats to child development.* Greater Boston Physicians for Social Responsibility. Cambridge, MA, 2000.
- <sup>58</sup> World Resources Institute. *Pesticides and the immune system: The public health risks.* 1996.

- 
- <sup>59</sup> Whyatt et al. Residential pesticide use during pregnancy among a cohort of urban minority women. *Environmental Health Perspectives*, 110(5), 507-14.
- <sup>60</sup> Szpir, Michael. *Environmental Health Perspectives: Focus*. Vol. 114; 2. February 2006.
- <sup>61</sup> Sagrans, Erica. The Rat Patrol. *The Providence Phoenix*. November 11, 2005.
- <sup>62</sup> Centers for Disease Control and Prevention. Managing Rodents and Mosquitoes through Integrated Pest Management. Webcast.
- <sup>63</sup> Marsh A et al. Housing deprivation and health: A longitudinal analysis. *Housing Studies* 2000; 15(3): 411-428.
- <sup>64</sup> Dedman et al. Childhood housing conditions and later mortality in the Boyd Orr cohort. *J Epidemiol Community Health* 2001; 55 (1): 10-15.
- <sup>65</sup> McLean et al. Asthma among homeless children – Undercounting and undertreating the underserved. *Archives of Pediatric & Adolescent Medicine* 2004; 158 (3): 244-249.
- <sup>66</sup> Weinreb et al. Determinants of health and service use patterns in homeless and low-income housed children. *Pediatrics* 1998; 102 (3): 554-562.
- <sup>67</sup> Karr C, Kline S. Homeless children: What every clinician should know. *Pediatrics in Review* 2004; 25 (7): 235-241.
- <sup>68</sup> Wood et al. Health of homeless children and housed poor children. *Pediatrics* 1990; 86 (6) 858-866.
- <sup>69</sup> Alperstein et al. Health problems of homeless children in New York City. *American Journal of Public Health* 1988; 78 (9): 1232-1233.
- <sup>70</sup> Wood et al. Health of homeless children and housed poor children. *Pediatrics* 1990; 86 (6) 858-866.
- <sup>71</sup> Meyers et al. Subsidized housing and children’s nutritional status: Data from a multisite surveillance study. *Archives of Pediatric and Adolescent Medicine* 2005; 159 (6); 551-556.
- <sup>72</sup> Sandel, M. et al. There’s no place like home: How America’s housing crisis threatens our children; *Housing America*. San Francisco, 1999.
- <sup>73</sup> Rafferty Y et al. Academic achievement among formerly homeless adolescents and their continuously housed peers. *Journal of School Psychology* 2004; 42 (3): 179-199.
- <sup>74</sup> Zima BT et al. Sheltered homeless children: their eligibility and unmet need for special education evaluation. *Am J Public Health* 1997; 87 (2): 236-240.
- <sup>75</sup> Smith, Lauren et al. Affordable housing and child health: A child health impact assessment of the Massachusetts rental voucher program. *Child Health Impact Working Group*. June 2005.
- <sup>76</sup> Smith, Lauren et al. Affordable housing and child health: A child health impact assessment of the Massachusetts rental voucher program. *Child Health Impact Working Group*. June 2005.
- <sup>77</sup> Meyers et al. Subsidized housing and children’s nutritional status: Data from a multisite surveillance study. *Archives of Pediatric and Adolescent Medicine* 2005; 159 (6); 551-556.
- <sup>78</sup> Cook JT et al. Food insecurity is associated with adverse health outcomes among human infants and toddlers. *J Nutrition* 2004; 134 (6): 1432-1438.
- <sup>79</sup> Alaimo, K et al. Food insufficiency, family income, and health in US preschool and school-aged children. *Am J Public Health* 2001; 91 (55): 781-786.
- <sup>80</sup> Weinreb, L et al. Hunger: Its impact on children’s health and mental health. *Pediatrics* 2002; 110 (4).
- <sup>81</sup> MMWR. Use of Unvented Residential Heating Appliances – United States 1988-1994.
- <sup>82</sup> Stein L. A study of respiratory tuberculosis in relation to housing conditions. *Br J Soc Med*. 1950; 4:143-169.
- <sup>83</sup> Evans, Gary W. Child Development and the Physical Environment. *Annu. Rev. Psychol* 2006. 57:423-51.
- <sup>84</sup> Center for Housing Policy. America’s Newest Working Families: Cost, Crowding and Conditions for Immigrants. July 2003
- <sup>85</sup> Rhode Island Emergency Food and Shelter Board. Annual Report July 1, 2004 – June 30, 2005.
- <sup>86</sup> Rhode Island Emergency Food and Shelter Board. Annual Report July 1, 2004 – June 30, 2005.
- <sup>87</sup> Rhode Island Emergency Food and Shelter Board. Annual Report July 1, 2004 – June 30, 2005.
- <sup>88</sup> Rhode Island Emergency Food and Shelter Board. Annual Report July 1, 2004 – June 30, 2005.
- <sup>89</sup> Housing Works RI. Rhode Island’s Affordable Housing Fact Book. 2005.
- <sup>90</sup> Partnership to End Long-Term Homelessness. Costs of Serving Homeless Individuals in Nine Cities. November 2004
- <sup>91</sup> Turner et al. Distressed Public Housing – What it costs to do nothing. The Urban Institute, April 2005.
- <sup>92</sup> Turner et al. Distressed Public Housing – What it costs to do nothing. The Urban Institute, April 2005.

- 
- <sup>93</sup> Rhodes to Independence 2005 Annual Report
- <sup>94</sup> U.S. Census 2000. Cited in Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>95</sup> Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>95</sup> Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>96</sup> Rhodes to Independence 2005 Annual Report
- <sup>97</sup> Rhodes to Independence Housing Focus Group Report, 2005.
- <sup>98</sup> Participant, Rhodes to Independence Housing Focus Groups, 2005.
- <sup>99</sup> The National Resource Center on Supportive Housing and Home Modification. Cited in Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>100</sup> RI Long Term Care Spending Report. Cited in Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>101</sup> Long Term Care Spending Report, 2004. Cited in House Bill 7629 Fact Sheet: Home-Modifications Revolving Fund for People with Disabilities and the Elderly.
- <sup>102</sup> Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>103</sup> Rhodes to Independence Issue Brief: Home Modifications for People with Disabilities and the Elderly
- <sup>104</sup> National Center for Health Statistics (NCHS), National Vital Statistics System.  
<http://www.health.ri.gov/disease/saferi/data/leadingcausesdeath.pdf>
- <sup>105</sup> Rhode Island Vital Statistics Data, 1999-2003.  
<http://www.health.ri.gov/disease/saferi/data/leadingcausesinjurydeath.pdf>
- <sup>106</sup> Rhode Island Department of Health, Maternal and Child Database, 2000-2004
- <sup>107</sup> Rhode Island Hospital Discharge Data, 1999-2003.  
<http://www.health.ri.gov/disease/saferi/data/leadingcausesinjuryhosp.pdf>
- <sup>108</sup> U.S. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2005. <http://www.health.ri.gov/disease/saferi/data/YPLLTable-Revised.pdf>
- <sup>109</sup> UpToDate, 2006
- <sup>110</sup> Richardson G, Eick S and Jones R. How is the indoor environment related to asthma?: literature review. *J Adv Nurs* 2005;52(3):328-39.
- <sup>111</sup> Runyan et al. Risk factors for fatal residential fires. *N England Journal of Medicine* 327: 859-863, 1992
- <sup>112</sup> Council on Scientific Affairs. Preventing death and injury from fires with automatic sprinklers and smoke detectors. *JAMA* 257: 1618-1620, 1987
- <sup>113</sup> Fergusson, David M Grant, Hildegard Horwood, L John Ridder, Elizabeth M. Randomized trial of the Early Start program of home visitation. *Pediatrics* 2005;116(6):e803.
- <sup>114</sup> King, W J Klassen, T P LeBlanc, J Bernard-Bonin, A C Robitaille, Y Pham, B Coyle, D Tenenbein, M Pless, I B. The effectiveness of a home visit to prevent childhood injury. *Pediatrics* 2001;108(2):382.
- <sup>115</sup> Shenassa, Edmond et al. Social disparities in housing and related pediatric injury: a multilevel study. *American Journal of Public Health*. Vol 94, No. 4, April 2004.
- <sup>116</sup> American Lung Association, American Medical Association, U.S. Consumer Product Safety Commission and U.S. Environmental Protection Agency. *Indoor Air Pollution: An Introduction for Health Professionals*. December 2005.
- <sup>117</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. *The Inside Story: A Guide to Indoor Air Quality*. April 1995.
- <sup>118</sup> National AG Safety Database. *Questions About Indoor Air Quality*. April 2002.
- <sup>119</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. *The Inside Story: A Guide to Indoor Air Quality*. April 1995.
- <sup>120</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. *The Inside Story: A Guide to Indoor Air Quality*. April 1995.
- <sup>121</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. *The Inside Story: A Guide to Indoor Air Quality*. April 1995.
- <sup>122</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. *The Inside Story: A Guide to Indoor Air Quality*. April 1995.
- <sup>123</sup> American Lung Association, American Medical Association, U.S. Consumer Product Safety Commission and U.S. Environmental Protection Agency. *Indoor Air Pollution: An Introduction for Health Professionals*. December 2005.



- 
- <sup>124</sup> U.S Environmental Protection Agency and the U.S. Consumer Product Safety Commission. The Inside Story: A Guide to Indoor Air Quality. April 1995.
- <sup>125</sup> Environmental Protection Agency. An Introduction to Indoor Air Quality. December 2006.
- <sup>126</sup> American Lung Association. Smoking 101 Fact Sheet. March 2006.
- <sup>127</sup> CDC. Annual Smoking-Attributable Mortality, Year of Potential Life Lost, and Productivity Losses: US 1997-2001. July 1,2001.
- <sup>128</sup> American Lung Association. Smoking 101 Fact Sheet. March 2006.
- <sup>129</sup> US Department of Health and Human Services. New Surgeon General's Report on the Effects of Secondhand Smoke. June 27, 2006.
- <sup>130</sup> US Department of Health and Human Services. New Surgeon General's Report on the Effects of Secondhand Smoke. June 27, 2006.
- <sup>131</sup> American Lung Association. Secondhand Smoke Fact Sheet. August 2006.
- <sup>132</sup> US Department of Health and Human Services. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. June 27,2006.
- <sup>133</sup> American Lung Association. Secondhand Smoke Fact Sheet. August 2006.
- <sup>134</sup> American Lung Association. Secondhand Smoke Fact Sheet. August 2006.
- <sup>135</sup> US Department of Health and Human Services. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. June 27,2006.
- <sup>136</sup> American Lung Association. Secondhand Smoke Fact Sheet. August 2006.
- <sup>137</sup> American Lung Association. Secondhand Smoke and Your Family. August 2006.
- <sup>138</sup> Healthy People 2000. Healthy Rhode Islanders Progress Review 2000. 2000.
- <sup>139</sup> Commission for Environmental Cooperation. Children's Health and the Environment in North America. 2006
- <sup>140</sup> Childhood asthma: an overview (2005). New York, NY: American Lung Association. [www.lungusa.org](http://www.lungusa.org)
- <sup>141</sup> Lanpher et al. Residential exposure associated with asthma in US children. Pediatrics. 2001; 107; 505-511.
- <sup>142</sup> Lanpher et al. Residential exposure associated with asthma in US children. Pediatrics. 2001; 107; 505-511.
- <sup>143</sup> Lanpher et al. Residential exposure associated with asthma in US children. Pediatrics. 2001; 107; 505-511.
- <sup>144</sup> Dey AN, Schiller JS, Tai DA. Summary health statistics for U.S. children: National health interview survey, 2002. National Center for Health Statistics. Vital Health Stat 10 (221). 2004.
- <sup>145</sup> RI BRFSS 2002
- <sup>146</sup> J Allergy Clin Immuno 2002 Feb; 109 (2): 264-70
- <sup>147</sup> MMWR. Surveillance for Asthma, US CDC 2002.
- <sup>148</sup> WebMD. Carbon Monoxide Poisoning: Cause. June 30, 2004.
- <sup>149</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>150</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>151</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>152</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>153</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>154</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>155</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>156</sup> MMWR. Unintentional Non-Fire-Related Carbon Monoxide Exposures – United States, 2001-2003. January 21,2005.
- <sup>157</sup> Asbestos News. Mesothelioma Statistics, 2006.
- <sup>158</sup> Asbestos News. Mesothelioma Statistics, 2006.
- <sup>159</sup> Asbestos News. Mesothelioma Statistics, 2006.

- 
- <sup>160</sup> Asbestos News. Mesothelioma Statistics, 2006.
- <sup>161</sup> Mesothelioma Hotline Information. Mesothelioma Statistics. 2006.
- <sup>162</sup> Mesothelioma Hotline Information. Mesothelioma Statistics. 2006.
- <sup>163</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>164</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>165</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>166</sup> American Lung Association. Lung Disease Data:2006. 2006.
- <sup>167</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>168</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>169</sup> Healthy People 2000. Healthy Rhode Islanders Progress Review 2000. 2000.
- <sup>170</sup> Healthy People 2000. Healthy Rhode Islanders Progress Review 2000. 2000.
- <sup>171</sup> Healthy People 2000. Healthy Rhode Islanders Progress Review 2000. 2000.
- <sup>172</sup> Environmental Protection Agency. An Introduction to Indoor Air Quality. December 2006.
- <sup>173</sup> National AG Safety Database. Question About Indoor Air Quality. April 2002.
- <sup>174</sup> American Lung Association. Types of Available Air Cleaners. 2006.
- <sup>175</sup> American Lung Association. Air Cleaners. February 2000.
- <sup>176</sup> American Lung Association. Air Cleaners. February 2000.
- <sup>177</sup> American Lung Association. Air Cleaners. February 2000.
- <sup>178</sup> American Lung Association. Radon Fact Sheet. November 2006.
- <sup>179</sup> AAP. Noise: A Hazard for the Fetus and Newborn. *Pediatrics* 1997;100(4):724-7.
- <sup>180</sup> Trapanotto M, Benini F, Farina M, Gobber D, Magnavita V and Zacchello F. Behavioural and physiological reactivity to noise in the newborn. *Journal of Paediatrics & Child Health* 2004;40(5/6):275.
- <sup>181</sup> Stansfeld SA, Berglund B and Clark C, et al. Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet* 2005;365(9475):1942.
- <sup>182</sup> Lercher P, Evans GW, Meis M and Kofler WW. Ambient neighbourhood noise and children's mental health. *Occup Environ Med* 2002;59(6):380-6.
- <sup>183</sup> Lercher P, Evans GW, Meis M and Kofler WW. Ambient neighbourhood noise and children's mental health. *Occup Environ Med* 2002;59(6):380-6.
- <sup>184</sup> Folmer, Robert L Griest, Susan E Martin, William Hal. Hearing conservation education programs for children: a review. *The Journal of school health* 2002;72(2):51.
- <sup>185</sup> Knoblock MJ, Broste SK. A Hearing Conservation Program for Wisconsin Youth Working in Agriculture. *Journal of School Health* 1998;68(8):313.
- <sup>186</sup> Evans GW, Gonnella C, Marcynyszyn LA, Gentile L and Salpekar N. The Role of Chaos in Poverty and Children's Socioemotional Adjustment. *Psychological Science* 2005;16(7):560-5.
- <sup>187</sup> National Environmental Trust, Physicians for Social Responsibility, and Learning Disabilities Association of America. Polluting our future: Chemical pollution in the U.S. that affects child development and learning. September 2000. [www.safekidsinfo.org](http://www.safekidsinfo.org)
- <sup>188</sup> National Academy of Sciences. Committee on Developmental Toxicology. *Scientific Frontiers in Developmental Toxicology and Risk Assessment*. Washington, DC: National Academy Press, 2000.
- <sup>189</sup> National Environmental Trust, Physicians for Social Responsibility, and Learning Disabilities Association of America. Polluting our future: Chemical pollution in the U.S. that affects child development and learning. September 2000. [www.safekidsinfo.org](http://www.safekidsinfo.org)
- <sup>190</sup> Kennedy D, Bates RR, editors. *Air pollution, the automobile and public health*. Washington DC: National Academy Press; 1989.
- <sup>191</sup> Committee of the Environmental and Occupational Health Assembly, American Thoracic Society. Health effects of outdoor air pollution. *Am J Respir Crit Care Med* 1996; 153: 3-50, 477-98.
- <sup>192</sup> Friedman et al. Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *JAMA* 285 (7): 897-905, 2001
- <sup>193</sup> Wernette DR et al. Breathing polluted air: Minorities are disproportionately exposed. *EPA Journal* 1992; 18:16-17.
- <sup>194</sup> Finkelstein et. al. National medical spending attributable to overweight and obesity: how much, and who is paying? *Health Affaris* 2003; W3:219-26
- <sup>195</sup> Horowitz et. al. Barriers to buying healthy foods for people with diabetes: evidence of environmental disparities. *Am J Public Health* 2004; 94:1549-54

---

<sup>196</sup> Zenk et. al. Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med* 2002; 22:23-9

<sup>197</sup> Inagami et al. You are where you shop: Grocery store locations, weight, and neighborhoods. *Am J Prev Med* 2006; 31 (1)

<sup>198</sup> Robert Wood Johnson Foundation. "Health Impacts of a Fair Housing Demonstration Include Less Adult Obesity." [www.rwjf.org](http://www.rwjf.org)



**RI Childhood Lead Poisoning Prevention Program  
3 Capitol Hill, Room 302  
Providence, RI 02908**

**[www.health.ri.gov/lead](http://www.health.ri.gov/lead)**