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## About this Report

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## Executive Summary

Every Oregonian deserves an affordable, healthy home where they can thrive. Many of our aging residents have been living in manufactured homes that continue to stand despite the structure having aged beyond its expected product life span. Since the 1950s, on both rural and urban lands, manufactured homes make up 9.9% of homes in the state of Oregon.<sup>1</sup> These homes provide affordable housing to 6,000 residents in Curry County, representing 33% of total housing stock.

Older manufactured homes from the 1970s and 80s can transition into substandard homes that are difficult to heat and cool and become a relative petri dish for molds that can make a resident's existing health conditions worse (see figure 1). Costs can make repairing or replacing a manufactured home difficult for many residents. For this reason, multiple partners collaborated to explore the potential to establish a program - called the Housing Stock Upgrade Initiative (HSUI) - that would provide lower cost loans or other funds to make repairing or replacing a home more affordable to residents in Curry County, Oregon. If the program is established, partners agreed to also consider the possibility of expanding this pilot program for a future state-wide effort.



**Image 1: An example of an older manufactured home and a replacement model**

### Health Impact Assessment and the Housing Stock Upgrade Initiative

The information in this Health Impact Assessment (HIA) informed multiple decision makers during the development of the HSUI pilot project. A Health Impact Assessment is a structured tool to help decision makers identify potential benefits and prevent negative consequences of a proposal to promote human health. This HIA happened at the same time as the HSUI development process convened by the Oregon Solutions program. This HIA informed each of the partners involved in creating a viable funding package for homeowners who want to replace or retrofit their manufactured homes with energy efficient, safer, and more valuable manufactured homes. Decision makers

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<sup>1</sup> This comes from a source that may not be reliable known as statemaster.com

included Neighbor Works Umpqua, Community Development Corporations, The Oregon Manufactured Home Association, the United States Department of Agriculture (USDA) Office of Rural Development, the Oregon Department of Energy, Oregon's Infrastructure Finance Authority, manufactured home owners, manufactured home park land owners, and other public, private and civic organizations.

### **Manufactured Housing and Health**

This HIA examined the potential health impacts of the difference the HSUI program could have on manufactured resident's health based on retrofitting or replacing substandard manufactured homes. The research team found from examining existing conditions of manufactured homes, current health conditions of residents of Curry County, peer-reviewed literature, and conducting home site visits and interviews with residents the potential the HSUI program could have on resident's health. The HSUI program has the potential to improve indoor air quality and home structural integrity as well as increase the potential for residents to stay in their homes as they age. The HSUI has mixed implications for resident stress because of the cost of repair or replacement cost and potential financial debt among residents. For the Curry County population generally, there is the potential for local jobs to repair and manufacture homes to support family employment and its health benefits.



Image 2: Water and roof damage

### **Recommendations**

Primary recommendations include specific design changes to manufactures for new homes to address resident's needs as they age, suggestions to provide the best product at the best price, for homes to be made and repaired hiring local residents as much as possible, raising awareness among homeowners about program availability, and ongoing monitoring of applicant access and eligibility.

# **1: Introduction**

## **Manufactured Homes in Curry County and Health**

This Health Impact Assessment, and a parallel Oregon Solutions process, was initiated by the Curry County Board of Commissioners staff to address a growing community health need in the region: manufactured home disrepair. For example, over 40% of Curry's manufactured homes predate 1980 - indicating they are past their recommended usage period and needing repair. This community health need also aligned with an economic development imperative to create much needed jobs in Curry by bolstering demand for contractor services. Additionally, Curry's primary economic driver, construction related industries, took a major downturn during the recession.

Curry's Health Impact Assessment was timely as it occurred while elected officials in Curry gathered with Oregon Solutions to discover how to improve the physical and economic health of Curry residents through a strategic investment in upgrading manufactured homes. Over 35% of Curry's residents are over 55 and retired. For retirees on low or fixed incomes, there are very limited resources available to fund needed repairs and replacement<sup>1</sup>. Upper respiratory conditions are the primary cause of hospitalization and ER utilization in Curry County<sup>2,3</sup>.

When people live in manufactured homes for many years beyond a home's designed life span, the worn-out living structures can lead to substandard housing conditions. Those on fixed, low, or moderate incomes often occupy manufactured homes and are vulnerable to economic challenges and likely without the financial means to repair or replace a home. Manufactured housing that has exceeded its usable life can affect resident health. Many of the homes that were built during or prior to the 1980's have become sorely substandard, often undermining an occupant's limited resources and general health. For example, worn out manufactured homes can exacerbate cardiovascular conditions such as asthma because of poor indoor air quality. Oregon's older manufactured housing stock is also inefficient in energy consumption, even after the investment of weatherization subsidies, which affects resident utility bills and has climate change implications.

## **Defining Manufactured Housing and Manufactured Home Parks**

Throughout the process of Curry's Housing Stock Upgrade Initiative (HSUI), it was important to cut through the assumptions about manufactured homes by differentiating between a factory-built home that is brought to a site largely intact and a trailer or mobile home. This lack of clarity largely lies in the roots and evolution of the contemporary manufactured housing industry from homemade travel trailers in the late 1920s. Arthur G. Sherman, the owner of a pharmaceutical company, constructed a travel trailer to take his family on vacation to the Upper Peninsula of Michigan during the summer of 1929<sup>4</sup>. Displeased with the tents on boxes he found on the market, he

constructed a nine-foot long and six-foot wide wooden box on wheels with bunks and a coal-burning stove. Given the interest in his homemade trailer, he rented a garage, hired a couple of workers, and started constructing trailers that sold for approximately \$300 at the time<sup>5</sup>.

From these modest beginnings, the industry grew. Although many units were used as vacation travel trailers during the Depression, the decline in housing resulted in a shortage and the use of trailers as year-round housing stock grew. Trailers were a prominent feature in some “Hooverilles,” which were Depression-era shantytowns and encampments of people who were ostensibly homeless<sup>5</sup>. Adequate sanitation was lacking. As with tenements during an earlier era, public concern grew over the potential for loose morals and lax ways in such crowded conditions. By the late 1930s, trailer parks had landed a reputation for being unsavory.

The transition from trailer to mobile home happened in the mid 1950s, Elmer Frey, owner of the manufacturer Marshfield Homes in Marshfield, Wisconsin, developed a ten-foot wide model requiring a special highway permit to move through the region. He didn’t design his model with the intention of being pulled behind a vehicle on a regular basis. Instead, he designed and envisioned it as a year-round home constructed in a factory and hauled to a site where it was installed. He argued that it wasn’t a travel trailer, but rather a “mobile home”<sup>5</sup>. Today’s manufactured homes are descendants of the recreational “pull-behind” trailers of the 1930s and 40s, yet do not look like their predecessors. By 1960, 1.3% of the entire U.S. housing stock and 2.3% of Oregon’s housing stock was comprised of mobile homes and trailers. The number of mobile and manufactured homes rose 1000% from 1960 to 2000<sup>6</sup>.

Mobile homes of varying quality were produced in the 1960s. To address concerns about quality, Congress adopted the first and only national building code in 1974, the Mobile Home Construction and Safety Act, commonly called the “HUD8 Code.” It preempted all other state and local codes that dealt with the construction of mobile homes. To this day, manufactured homes are the only type of housing constructed in compliance with a national building code that addresses regional differences in environmental conditions.

A “manufactured home” is a mobile home built after June 15, 1976 (the effective date of the HUD Code) and constructed in conformance with the HUD Code. The distinguishing characteristics of a manufactured home, besides complying with national standards for general construction, plumbing, heating, electrical systems and fire safety, are that it is built in a factory, has an integral chassis, and is transported to a site on axles and wheels attached to the chassis. For transport down a public highway, a manufactured home also has dimensional restrictions. It may be constructed and transported in sections, and the sections assembled onsite. It is distinguished from pre-fabricated housing, which is another form of factory-built housing, in that it is largely

assembled in the factory and transported on its own chassis rather than on a flatbed or other hauling device.

## 2: Why an HIA? Decision to Replace or Retrofit Aging Manufactured Homes

Curry's HSUI emerged as a perfect opportunity for the Curry County government Local Public Health Authority to conduct an HIA to inform the initial Curry County and State-level decisions for how and when aged manufactured homes are repaired, replaced or decommissioned.

Communities across the United States, and in Oregon, are increasing their use of Health Impact Assessments (HIA) to explore potential health impacts of a proposal that might otherwise be unexamined. HIAs identify factors that affect people's health - where they live, work, and play. For example, access to healthy foods, access to transportation, and clean air are factors that affect every day health. The National Research Council<sup>7</sup> defines an HIA as "a structured process that uses scientific data, professional expertise, and stakeholder input to identify and evaluate public-health consequences of proposals and suggests actions that could be taken to minimize adverse health impacts and optimize beneficial ones." This HIA aims to provide state decision makers with information on the relationship between aging manufactured homes and resident health.

### Health Impact Assessments involve six stages:

1. **Screening** determines the need and value of an HIA.
2. **Scoping** defines research questions, health determinants, health outcomes, vulnerable populations, a plan and a timeline for the assessment.
3. **Assessment** evaluates the direction and magnitude of potential health impacts using existing data, expertise, current conditions, and literature.
4. **Recommendation** uses assessment findings to identify actions that will minimize adverse health effects and optimize beneficial ones.
5. **Reporting** communicates the findings and recommendations.
6. **Monitoring and Evaluation** tracks changes in health.

The methods for the HIA describing how the research team moved through each stage are described in the Appendix. The research team selected key health factors that could be affected by the HSUI project and impact Curry's most vulnerable groups. The team then conducted a short literature review, examined current health data for Curry County residents, and interviewed manufactured home residents about their concerns and their understanding of the potential HSUI program. The team reviewed this information and characterized potential health impacts. The team brought draft recommendations to the HSUI team for input and revisions. This report reflects this process.

This HIA was built on Curry County Public Health Department's Community Health

Assessment. The Community Health Assessment identified significant data regarding chronic respiratory conditions in Curry as well as significant data regarding Curry's housing burden; for example, over 50% of Curry's residents are paying more than 30% of their income on housing costs<sup>2</sup>. Curry County's Community Health Status Assessment Priority areas include:

- Reduce chronic disease through education and outreach
- Improve quality and availability of affordable housing
- Improve health care screening so that patients with chronic diseases are screened for conditions that may be associated with indoor air quality, allergies, or other conditions related to personal dwellings.

In the winter of 2012, the Curry County Board of Commissioners applied to be designated an Oregon Solutions project for a manufactured home upgrade project. In the same time period, staff at Curry County applied for funding to complete an HIA on the future Oregon Solutions project. The HIA was intended to ensure a broad public health perspective was part of the entire HSUI decision-making process (see table 1). HIAs typically inform decision makers before a decision on a project are made. In this process, decisions were made throughout the spring of 2013 that would affect the repair and replacement of manufactured homes in the development of the ReHome program – and therefore the health of residents and the community.

The primary objective of this collaborative project is to identify and integrate sufficient resources, incentives, and savings from energy efficiencies so that homeowners have a financially realistic opportunity to replace or repair their manufactured homes. The team is working to produce the following outcomes:

- Innovative (impossible to say “no”) manufactured housing replacement financing schemes, such as up-front small buy-down grants coupled with partial deferred-payment loans, geared toward low- or fixed-income homeowners.
- Incentive packages.
- Funding for a Pilot initiative, including housing assessments and worker training, and county staffing support.

Decision makers include NeighborWorks Umpqua, Community Development Corporations, The Oregon Manufactured Home Association, USDA Office of Rural Development, the Oregon Department of Energy, Oregon's Infrastructure Finance Authority, manufactured home owners, manufactured home park land owners, and other public, private and civic organizations. This HIA informs partners involved in creating a viable funding package for homeowners who want to replace or retrofit their manufactured homes with energy efficient, safer, more valuable manufactured homes. The goals of this HIA are to:

1. Assess the health impacts of manufactured housing and resident and community health.
2. Provide health related information and recommendations to inform stakeholders planning for manufactured housing repair, replacement, and decommissioning.
3. Communicate findings and strategies to key stakeholders including the Oregon Infrastructure Finance Authority Board, lenders, homeowners, renters, funders, residents, and other counties in Oregon facing similar challenges.

**Table 1 - Interaction between HIA and HSUI**

2013	Jan	Feb-March	April - June	July	August -forward
<b>HSUI</b>	Oregon Solutions application	Designation	Partner involvement, resources	Declaration of Commitment signed (DOC)	DOC Implementation
<b>Stakeholder engagement</b>			Interviews, Meetings	HSUI team gives feedback to draft findings and recommendations	HIA informs future decisions in DOC
<b>HIA Stages</b>	Screening	Scoping	Revise Scope, Assessment	Finalize Assessment, Draft Recommendations	Finalize: Assessment Recommendations Monitoring and Evaluation

This HIA will also inform the NW Power & Conservation Council's Regional Technical Forum (RTF). RTF is an advisory committee established in 1999 to develop standards to verify and evaluate conservation savings, which sets new standards and also determines the discount eligibility for the BPA's conservation program participants. The RTF will consider recommendations of Northwest Energy Works for specifications related to the Northwest Energy Efficient Manufactured Home Program (NEEM) Energy qualified homes.

NW Energy Works in collaboration with Karen Chase, HSUI Pilot Coordinator, and the Manufactured Housing Association will be presenting these recommendations to the RTF for adoption following the final HIA report in August 2013. Their standards can be adopted into rule by, for example, the Oregon Building Codes Division - making it mandatory, but before this, cities and counties can adopt them voluntarily.

### **Pathways to Health: HIA Scope and Assessment Topics**

This HIA examines several health factors and their related health outcomes (see figure 1) decided in the Scoping stage (see the Appendix). HIA researchers talked to manufactured housing residents regarding their quality of life, health status, and desirability to repair or replace their housing as part of the HSUI listening sessions in conjunction with this HIA.

### Aging in Place and Quality of Life

The term “aging in place” is used to describe people growing old in familiar environments. The majority of older adults prefer to continue to live in their current home and maintain their daily routines<sup>8</sup>. Researchers indicate that living at home can promote a sense of personhood and lessen some of the stress related to multiple personal losses, age-related declines and chronic illness<sup>9-11</sup>. Because more than half of Curry County’s residents are over the age of 55, this was a priority health factor.

### Home Structural Integrity and Injuries

For residents living in pre-1980 homes, the risks of upper respiratory conditions, falls, and fire risk are probable based failing infrastructure over time. The research team included this health factor because of how a fall or other illness could make existing health conditions worse for older residents.

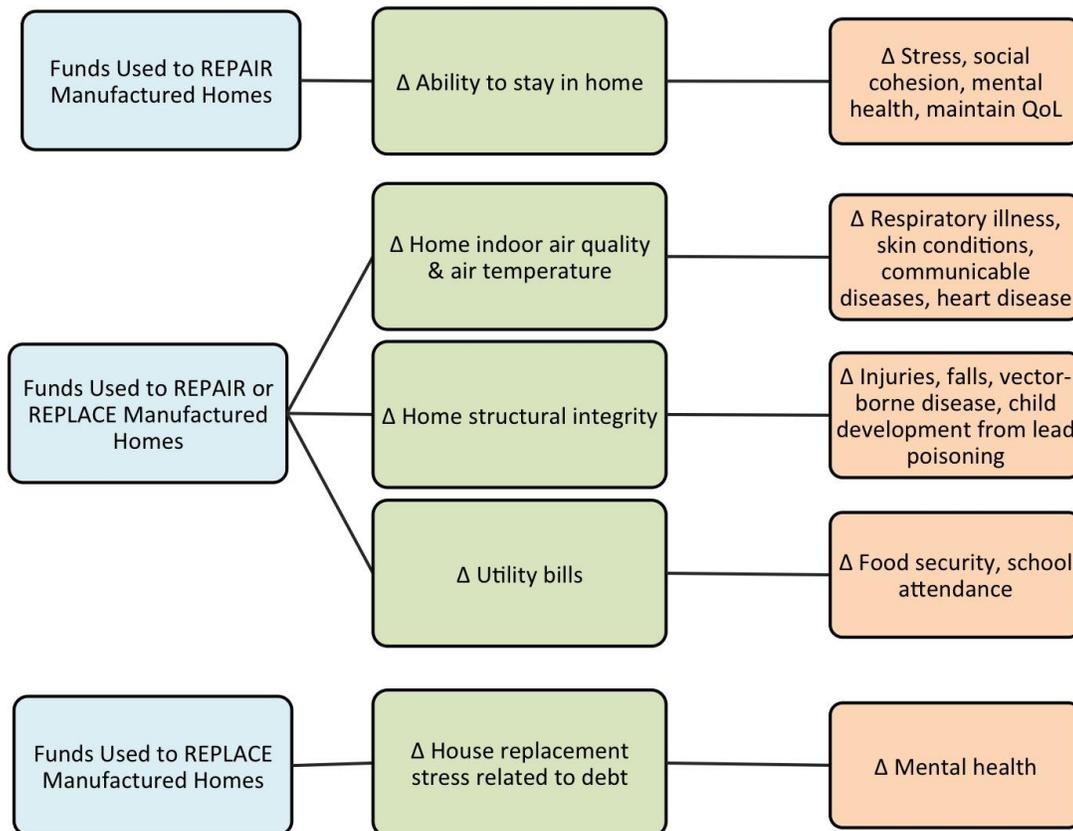


Figure 1 – Potential health determinant pathway diagram for ReHome project’s impact on public health (QoL = Quality of Life)

### **Utility Costs, Food Security, and School Attendance**

In the scoping discussion the research team was concerned that people living in manufactured homes would be at risk of economic hardship. Anecdotally people understood that if a family already has a challenge making rental costs, there is the potential to struggle with paying for food and heating bills. The group also shared a concern about residents with children or grandchildren and how respiratory illness or injuries in the previous category could affect a child's ability to attend school.

### **Air Quality and Respiratory Illness**

Curry County's Community Health Assessment demonstrates the burden that upper respiratory conditions and falls have on the local health care system. Underlying contributors to Curry's primary health conditions include poverty burdened by limited availability of safe and affordable housing, tobacco use, and substance abuse.

Asthma has increased in Curry County while remaining stable across Oregon. In 2004-2007, the prevalence of asthma in Curry was 9.9% and increased to 12.6% in 2006-2009<sup>3</sup>. Reasons for such a large increase in asthma prevalence may, in part, be attributable to high rates of smoking (18.4%), high rates of obesity (30%), and the high percentage of people living in sub-standard homes, including manufactured homes. This is especially relevant to the 44% of manufactured homes built before 1980. In Oregon, asthma healthcare costs are \$93 million in direct costs and \$71 million indirect<sup>12</sup>. Indirect costs are associated with lost wages for individuals unable to work due to Chronic Upper Respiratory Conditions.

This HIA will add valuable community health information to county and state discussions on how to best address aging manufactured homes in Curry County, and apply this information to other parts of Oregon.

### 3: Arriving at Health: Assessment of Manufactured Home Repair or Replacement on Resident Health

#### Baseline Health and Housing Conditions

This HIA examined baseline conditions of the health factors that may be affected by the HSUI program and in turn impact resident’s health. Health determinants, also called health factors in this report are the social and physical environments where we live, work, and play. These factors affect our health<sup>13</sup>. Beyond the current conditions, this section describes existing research on each health topic and information gathered from stakeholders involved in the HSUI project. The HIA also examined equity impacts, or which vulnerable populations may benefit the most as well as potentially take on added burden from decisions made.

#### Manufactured housing

As of 2013, 9.9% of homes in the state of Oregon are manufactured homes<sup>2</sup>. According to the most recent Curry County Assessor’s report, there are 12,346 single-family households (including duplexes and tri-plex units) in Curry County<sup>14</sup>. Of these, 33% of Curry County homes are manufactured. The following table shows how many homes on private property were built in each time period.

**Table 2- Number and age of manufactured homes in Curry County not in parks**

	Total	Built before 1980	Built between 1950-1969	Built between 1970-1982	Built between 1983-1999	Built between 2000-newer	Blank
<b>Number of MH Homes</b>	3876	1105	256	924	910	434	15
<b>Percentage</b>	100%	44%	10%	36%	36%	17%	

Based on data illustrated in the table below, it is estimated that a minimum of 604 homes in Curry have a high probability of compromised structural integrity. It is important to note that data was derived directly from the Curry County Assessor’s office (July 2013). Characterized conditions are based on the status of the home when initially assessed (see table 3). For example, if a home was assessed as good when purchased in 1990, it is still listed for actuarial purposes as “good” despite 23 years of wear and tear. For this reason, HIA researchers anticipate the numbers of homes listed as good or average are overly optimistic of the current condition of manufactured homes built prior to 1980.

**Table 3- Condition of Manufactured Homes in Curry County**

	Total	Excellent	Good	Average	Fair	Poor	Depreciation	Blank

<sup>2</sup> This comes from a source that may not be reliable known as statemaster.com

<b>Number of MH Homes</b>	3876	32	72	2014	217	181	13	11
<b>Percentage</b>	100%	1.3%	2.8%	79.3%	8.5%	7.1%	0.5%	

### Rental housing

A large portion of South Coast Region residents, 50% of homeowners and 55% of renters in Curry County, spend more than 30% of their income on housing costs; more than the state and national averages (Curry County Health Assessment, 2013).

Affordable housing costs (rent or mortgage) generally fall below 30% of a family’s household income. An indicator of a community’s affordability is the percent of families who pay more than 30% of their income in housing costs. Of manufactured home residents, 51% rent space where the home is located and approximately 80% of space renters own their homes.

Many Oregonians find affordable homes in manufactured home parks. In 2000, three quarters of Oregon’s 149,000 manufactured homes were owner occupied<sup>15</sup>. Forty three percent (65,469) of Oregon’s manufactured homes are located in the state’s 1,300 manufactured home parks<sup>16</sup>. The average rental cost of space in a manufactured home parks is \$413 a month. Curry residents’ average social security monthly payment is \$1,230 indicating home renters fall within the group spending more than 30% of their income on housing.

### Curry County Demographics

Curry County spans a geographic area of 1,648 square miles and supports a population base of 22,358 from Port Orford to Brookings. Brookings is the county’s most populated city and represents 75% of Curry’s population. The Forest Service owns 59% of land within county borders. Approximately 20% of land is available for private ownership. Curry’s population density is 13.6 people per square mile and has a population growth rate much lower than the state average rate of 39.9<sup>14,15</sup>.

In Curry County, 46.2% of all residents are over the age of 55. The size of the County’s 65+ population is twice Oregon’s state average. Data demonstrates a 33% occupancy rate in manufactured homes in Curry County, with 44% of the counties residents being over 65, suggesting that elderly residents are among the primary residents of Curry’s manufactured homes. Home screening is an optimal opportunity to prevent exacerbated conditions. Consequently, considerations about health among aging populations in manufactured housing warrant analysis.

**Table 4 - Curry County resident demographics<sup>14</sup>**

Age		Race and Ethnicity	
		Total Population	22,364 (100%)
Under 5	4.1%	Not Hispanic or Latino	94.6%

5-19	14.3%	White alone	88.7%
20-34	11.3%	Black or African American alone	0.3%
35-54	24.1%	American Indian or Alaska Native alone	1.7%
55+	46.2%	Asian alone	0.7%
		Native Hawaiian or Pacific Islander	0.1%
		Other race alone	0.1%
		Two or more races	3.0%

### **Education**

High school dropout rates have more than doubled in Curry County since 2005, increasing from 2.3% to 5.34% in 2010. Conversely, statewide high school dropout rates have steadily declined over the past 10 years from 5.3% in 2000 to 3.4% in 2010 (County Level Data, Oregon and California Departments of Education). Greater discrepancy exists with the percentage of people with a college or higher level of education. Just 18.5% of residents in Curry County have a college degree or higher level of education, compared to 28.6 % in Oregon and 28.2% nationally<sup>15,17</sup>.

### **Economy**

From 2010 to 2012, Curry County’s seasonally adjusted unemployment rate has steadily decreased from 12.9% to 11.5% in contrast to the Oregon statewide average of 7.8% (US Bureau of Labor Statistics, 2013). In 2007, Oregon and California Railroad grant land (O&C) funds were cut from the Curry County budget, which resulted in approximately \$7 million dollars or a 59% reduction in the county’s total budget. In 2000, the five Oregon counties with the lowest median family income were Curry, Lake, Josephine, Coos, and Klamath. These five counties were also among the highest in the percentages of families, individuals, and families with children under 18 living below the federal poverty line.

### **Vulnerable Populations**

Curry County resident’s educational levels and economic status put residents at greater risk of lower health conditions in which our most vulnerable populations live, i.e., the elderly and children<sup>17</sup>. Curry County population’s is aging - 46% of residents are over 55 and are more vulnerable to aged housing conditions with mold and compromised structural integrity due to the prevalence of primary chronic conditions such as asthma, arthritis, and heart disease.

### **Substandard Housing: Manufactured Homes and Health Literature Review**

Based on decades of research, substandard housing contributes to poor health outcomes with evidence showing that those who have the least resources at their disposal suffer

the worst conditions<sup>18-25</sup>. Substandard housing is lacking in necessary plumbing fixtures, heating, and or electricity, and holds various maintenance problems such as water leaks and cracks in the walls. Substandard housing is not limited to one specific residential type but tends to occur within older housing units and lower income households.

Exposure to these conditions directly affects both physiological and biochemical processes<sup>20,24</sup>. Substandard housing places socioeconomically disadvantaged populations in double jeopardy because of already existing health disparities and the higher likelihood to live in lower-cost housing<sup>26</sup>.

The condition of substandard housing contributes to adverse health effects in five broad categories, physical conditions, chemical conditions, biological conditions, building and equipment conditions, and social conditions<sup>24</sup>.

Physical conditions include reduced energy efficiency, radon exposure, noise, inadequate light and ventilation, and fine particulates in the home. Chemical conditions include high prevalence of carbon monoxide, volatile organic chemicals, secondhand smoke, and lead. Biological conditions in substandard housing include the presence of rodents, house dust mites, cockroaches, humidity and mold and their associated allergens. Building and equipment conditions include any accidents and unintentional injuries as a result of built features in the home and lastly, social conditions in substandard housing include architectural features related to mental health and overcrowding<sup>24</sup>.

### **Indoor Air Quality**

A primary health concern for aged manufactured homes (defined as pre 1980) is indoor air quality. Residents of substandard housing have an increased risk of chronic illness due to water leakages, inadequate ventilation, and overcrowding<sup>20,27</sup>. These attributes create a nurturing environment for mites, roaches, viruses, and molds<sup>20</sup> resulting in allergic, respiratory, neurological, and hematologic illnesses<sup>28-30</sup>. Substandard housing particularly increases rates of asthma by exposing residents to irritating factors and these long-term exposures can be life-threatening, especially in children<sup>31</sup>. Lack of heating in substandard housing can also cause dangerous asthma flares and has been associated with an increased risk of cardiovascular disease in the elderly, due to colder indoor temperatures<sup>30-33</sup>.

Residents of manufactured homes, compared to conventional homes, are at increased health risk via indoor air pollution due to both structural space and materials used<sup>34,35</sup>. Indoor contaminants include volatile organic compounds (VOC) emitted from building materials, cleaning products, cooking fuel, carbon monoxide from fireplaces or wood stoves, and other sources. Proper ventilation determines the air quality within a home unit. In manufactured homes, air tightness required by federal manufacturing guidelines and lower ventilation rates result in higher concentrations of gaseous

contaminants generated indoors<sup>36</sup>. The evidence particularly points to VOC, formaldehyde, and mold exposure in manufactured homes.

### **Formaldehyde**

Health effects of exposure to formaldehyde are greatest when the product is new, at warm temperatures and in areas of high humidity<sup>37,38</sup>. Exposure has shown to cause eye irritation, wheezing and skin irritation<sup>35,39</sup>. While formaldehyde has been found to decrease over time<sup>40,41</sup> it is still a significant respiratory irritant and health threat to residents, especially those with asthma or who have been sensitized<sup>42</sup>, and has been found to be a human carcinogen with prolonged exposure<sup>43,44</sup>.

### **Mold**

Due to smaller volumes and lower infiltration rates, manufactured homes have higher indoor relative humidity creating an environment conducive to mold and mildew<sup>42,45,46</sup>. The molds, or fungal spores, then enter the living space and cause an indoor air quality problem, leading to health complications such as asthma and respiratory conditions<sup>28,47</sup>. Structural damage due to condensation and mold can also occur<sup>48</sup> compromising the safety of the home. Moisture problems can also be caused by overcrowding and high occupancy and improper ventilation in bathrooms and kitchens<sup>48</sup>.

Mold is of particular concern in manufactured housing for a variety of reasons, especially in areas of high moisture, such as the Oregon Coast. Mold is a fungus and spores produce allergens as well as airborne toxins (mycotoxins). These toxins frequently cause asthma attacks as well sneezing, watery eyes, itchiness, shortness of breath, and hypersensitivity to pneumonitis. If mold problems are not addressed, residents exposed to mold could develop fungal infections in the sinuses or lungs<sup>49,50</sup>.

### **Lead Poisoning**

Lead poisoning in substandard homes is concerning given the impact on the nervous system, particularly intelligence, behavior, and development of children<sup>51-53</sup>. Although several exposure paths to lead exist, exposure to lead-based paint and lead in the plumbing systems of substandard houses are a particularly strong source<sup>52</sup>. It occurs if the paint is in a form that can be inhaled or ingested (e.g., chipping, peeling, or pulverized to dust) and is most prevalent in housing built before 1978<sup>52,54</sup> and more common among poorer families living in substandard housing<sup>55-57</sup>. Evidence also points to research that poor housing increases malnutrition among children and undermines their education<sup>20,53,54</sup>.

## Building and Structural Conditions

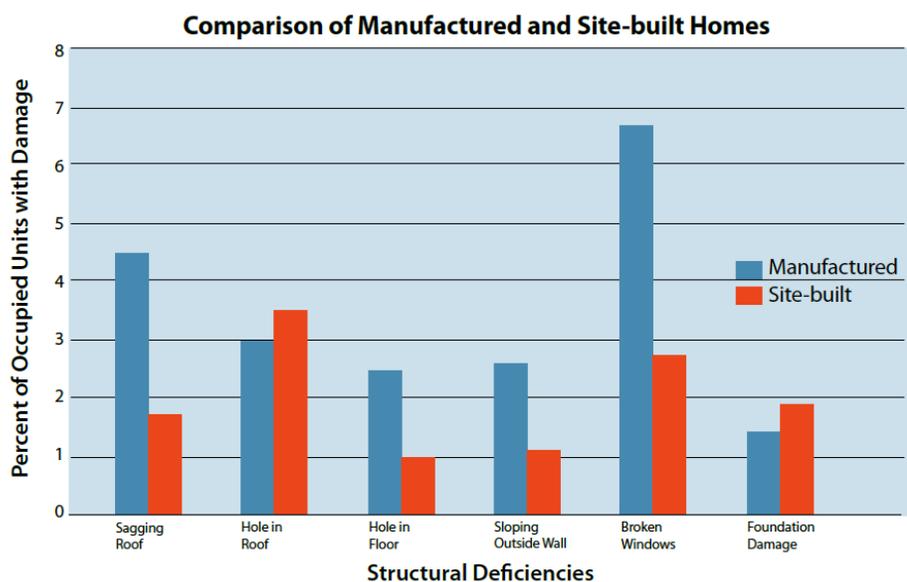


Figure 1-1: Damage assessment of occupied units of site-built and manufactured homes as reported by the 2007 American Housing Survey (U.S. Census Bureau 2007).

### Physical Hazards and Falls

Faulty flooring, stairs, lack of safety infrastructure, and pest infestations create physical hazards related to substandard housing conditions. These hazards lead to weaknesses in the structural integrity of homes, making residents more vulnerable to injury from falls. Falls in Curry, comparable to national statistics, are the leading cause of nonfatal injuries for infants, children, youth, and seniors (Curry Community Health Assessment, 2013). Nationwide, home-based falls account for almost half of all injuries requiring medical attention<sup>23</sup>.

### Fire Injury

People living in aged-manufactured homes are at an increased risk of fire injury and death compared to those living in site-based homes<sup>58-60</sup>. Fires are most often started through heating equipment and smoking materials and are exacerbated by highly flammable materials used in manufactured homes<sup>58,61</sup>. Fire and electrocution due to faulty electrical systems are more prevalent in substandard manufactured homes<sup>23</sup>, with most fire-related injuries and deaths resulting from inhalation of smoke or toxic gases produced by the fire, rather than burns<sup>59</sup>. Limited access for residents to evacuate is another notable variable impacting death rates<sup>62</sup>.

The evidence suggests that youth and seniors are at highest risk for fire-related injuries and deaths. At an increased risk are African Americans, American Indians, and low-income households<sup>20,23</sup>. In 2002, there were 210 deaths and \$134 million in direct property damage caused by an estimated 17,200 structure fires in manufactured housing in the United States. Since the Manufactured Home Construction and Safety Standards (MCHSS) took effect in 1976, fire safety has improved; however, there are

still higher rates of deaths from fire in manufactured homes compared to other dwellings<sup>63</sup>.

### **Communicable Diseases**

Increased presence of rats, mice, and other invertebrate pests in substandard housing contributes to additional health hazards, including a variety of communicable diseases as well as asthma and other respiratory conditions<sup>20,57</sup>. Unsanitary conditions in substandard housing allow for the transmission of tuberculosis and bacteria-illnesses attributed to unsafe drinking water, raw sewage, and waste<sup>20,23,31</sup> (16, 55, 61). Structures that are in substandard condition are additionally threatened by rats, mice, and invertebrates.

The 2007 American Home Services (AHS) reported that of 70,000 occupied manufactured homes, 11% had signs of rats and mice. Rodents gnaw on electrical wires posing a fire hazard as well as damaging structures by burrowing. Rodents also aggravate allergies, spread disease, and transport fleas, lice, ticks, and mites. Rats and mice also contaminate food with urine, feces, and hair. Cockroaches and dust mites have been shown to exacerbate asthma, cross-referenced in the indoor air quality literature review portion of this HIA analysis<sup>64</sup>.

### **Aging in Place**

The Center for Disease Control and Prevention define Aging in Place as “the ability to live in one’s own home and community safely, independently, and comfortable, regardless of age, income, or ability level<sup>65</sup>.” As the population continues to age, a key health consideration is the health benefits of elderly residents aging in place, near their families and friends. Many of Curry’s elderly residents live in manufactured housing. Evidence overwhelmingly confirms the health and longevity variables associated with elders aging in their homes, as long as their homes are healthy and adaptable to their needs. By addressing critical repairs harmful to the health of aging populations there’s a likely reduction in costs associated with moving elderly residents into an assisted living or residential housing situation.

### **Aging in Place and Mental Health**

Shelter is a crucial to human survival<sup>66</sup>. Anecdotally, linkages between housing quality and health appear obvious; thin walls, mold, decayed floors and uneven stairs result in increased respiratory conditions and falls. Literary evidence, although limited and tentative, may suggest a relationship between housing quality and mental health. A review of literary evidence identifies decreased levels of self-esteem and increased anxiety about structural hazards among manufactured home residents who worry about maintenance and an unsubstantiated fear of crime<sup>32</sup>. Additionally, residents living in substandard homes, are four times as likely to experience isolation and depression than those in standard housing<sup>67</sup>.

### **Aging in Place and Physical Health**

Curry County emergency room visits and hospital discharge data suggest primary conditions are most frequently attributed to upper respiratory conditions and falls (Curry County Health Status Assessment, 2013). Both conditions are likely correlated with aging populations, currently or previously exposed to poor indoor air quality, and prone to falls. Structural damage such as falls associated with failing porches and floors are other plausible correlations. Correlative data is not currently available regarding the source (cause) of falls associated with the 55+ population.

### **Aging in Place and Social Cohesion**

Evidence suggests that manufactured homes have been placed further away from more positive public community facilities, especially when clustered or defined as “mobile or trailer parks”, due to zoning codes<sup>68-71</sup>. These clusters have been noted to create a lack of trust, a diminished sense of community, residential segregation, and stigmatization ultimately contributing to social exclusion and increased risk of mental illness<sup>34,71-73</sup>.

While younger families and middle-aged adults may feel more isolated, the evidence does show that mobile parks comprised of manufactured home units have the unique quality of providing a benefit to older adults and retirees through the facilitation of aging in place<sup>74,75</sup>. Research indicates that elderly and individuals of retirement age favor manufactured housing because it is inexpensive, provides a sense of security through close neighbors, and still offers a sense of independence<sup>75-77</sup>.

Despite lacking requirements promoting aging in place<sup>78</sup> among manufactured homebuilders and distributors, Naturally Occurring Retiring Communities (NORC) are growing in popularity. However, research recommends additional funds and policies be provided to provide manufactured housing NORCs<sup>4</sup> to vulnerable populations due to low incomes and susceptibility to worsening health outcomes with age<sup>79</sup>.

### **Cost of Utility Bills, Food Security & School Attendance**

High utility costs associated with mobile homes have shown to place severe stress on the financial security of the rural poor<sup>69</sup>. In an aging trailer with poor insulation, a study found that monthly energy bills topping \$200 were not unusual in Oregon<sup>69</sup> and that in harsh winters, low-income residents may spend up to 70% of their income on energy expenditures<sup>80</sup>. Such costs quickly consume a household's monthly income and often force hard choices between paying the light and heat bill or the rent and even purchasing food<sup>69,81</sup>.

Poor nutrition and food insecurity can lead to diet related illnesses as well as impair overall childhood development<sup>82</sup>. Children who are hungry and malnourished are more likely to suffer from hyperactivity, have dental caries (which, because of pain or infection, is a common cause of school absenteeism), and have lower academic achievement than children who are not hungry<sup>83</sup>. In addition, substandard living

conditions of aging housing units create a variety of other health risks that may affect school attendance.

The initial findings of a Health Impact Assessment of the Supplemental Nutrition Assistance Program (SNAP) found that poor indoor air quality in substandard housing triggers asthma, which is the third leading cause of hospitalization for children and has resulted in 14.4 million lost days of school among children nation-wide<sup>84</sup>. Research also shows that children who are living in poverty and in food insecure households are more likely to experience high levels of stress and develop severe behavioral and emotional problems<sup>82,85</sup> which have shown to have negative implications for academic success, attendance, and cognitive and social development<sup>82,86,87</sup>.

### **Stress and Debt Among Aging Populations (55+) and Contributing Factors**

Substantial evidence points to a strong association between socio-economic status and mental health, physical health, and mortality<sup>88-91</sup>. Less, and often varying, evidence is known specifically about the relationship of age, debt, and stress particularly within the aging population. When looking at contributing factors of debt in the aging population, studies do exist on credit card debt and mortgage debt.

Older Americans (50+) now have higher overall credit card debt than younger people with 38 percent reporting that home repairs have contributed significantly to that debt<sup>92</sup>. One study examined credit card debt and found that among adults, anxiety and stress does increase with the ratio of credit card debt to income and being in default, but that it accounts for little of the age debt anxiety association. However, stress regarding overall debt (not just credit card) does explain some of the age effect<sup>93</sup>.

Regarding mortgage debt, total debt burdens were highest among low-income pre-retirees<sup>94</sup> and rates of serious delinquency of older Americans outpaced that of younger homeowners from 2007-2012<sup>95</sup>. Associations between mortgage delinquencies and changes in health and health-relevant resources the over 50 population have been associated with increased incidence of mental health impairments. People who were delinquent were more likely to develop depressive symptoms and more likely to cut back on food purchases and prescription drugs<sup>96</sup>. Another study found that foreclosure rates in a given neighborhood are associated with increases in medical visits for mental health conditions (anxiety and suicide attempts), preventable conditions (hypertension), and physical complaints that could be stress-related<sup>97</sup>.

Americans age 50 and over represent 27% of all delinquencies and foreclosures in the housing crisis and losing a house represents a loss from which there is limited time to recover and for some, a recovery may be impossible given their age and limited incomes<sup>94</sup>.

#### **4: Substandard Housing: Stakeholder Engagement and Qualitative Assessment**

All of the manufactured home residents surveyed reside at or below the Federal Poverty Level (FPL) for Curry County (\$21,200 for 2013). For the purposes of this HIA, 100% of respondents have incomes at or below 65% of federal poverty. Given previously referenced research on the life-span of a manufactured house at 20 years, if built prior to 1980, only 1 of 27 study respondents live in a HUD approved manufactured home.

##### **Indoor Air Quality and Structural Integrity**

Overwhelmingly, residents interviewed demonstrated a keen awareness of the health hazards imposed by their housing and a desire to improve the conditions in which they live. The primary theme and most relevant to this study was the overwhelming acknowledgement of the health risks residents assume to have a “roof over their heads”. As several residents stated, “it may be a leaking roof, or half a roof with a tarp, but it is a roof.” In other words, the rotting floor and leaking roof are the only insulation residents have from homelessness.



Image 3 and 4: Resident-provided pictures of water damage

Respondents clearly identified the health related consequences of their housing, specifically related to mold and indoor air quality. It was widely acknowledged among most participants that they suffer from chronic upper respiratory conditions. One participant shared of her partner’s sleep apnea and his need for breathing equipment that cannot be utilized in their home because of excess moisture.

Tenant behaviors such as tobacco use, physical inactivity, poor nutrition, and drug and alcohol use are intervening variables that also affect conditions that may result from poor indoor air quality found in substandard manufactured housing. Utilizing a model of intervention that addresses both housing and tenant behavior should be considered by both county health departments and housing specialists.

In 2006, Multnomah County Health Department (MCHD) initiated a multifaceted childhood asthma reduction program in 2006. Teams of community nurses, community health workers, and environmental health specialists visited households of asthma patients to provide education about asthma, medication management, and asthma triggers. While in the home, the team conducted inspections to identify and remove environmental asthma triggers. This program significantly reduced asthma-related emergency department visits and hospitalizations for participating families<sup>3,68</sup>.

### **Aging in Place**

When posed with the question of manufactured housing and the benefits to health, such as aging in place, Curry residents were perplexed. To further understanding of the question, an example was referenced from a resident describing a neighbor noticing she hadn't left her house for a couple of days and checked-in. She wasn't feeling well and her neighbor asked if she needed soup and soda. She did and her neighbor provided assistance. After the referenced example and a brief citing from Andree Tremoulet, PhD, regarding aging in place, the room exploded with commentary. "Yes, of course, that is the upside of living in this community. We take care of each other." " We wouldn't want our elderly to go to a nursing home, we don't want to go to a nursing home-dignity is living in your own home."



Image 5: A failing porch in a manufactured home

### **Debt and Stress – Repair or Replacement Options**

Of particular interest during this focus group, while not a formally posed question, residents were queried about replacement versus home repair options. Initially residents completely disregarded replacement as an option, "we can't afford anything new". After presenting the option of a 3%, deferred loan and reassuring them that payment needn't be made prior to title transfer; (i.e. their children would not be hamstrung with their debt), there was an overwhelming interest in replacement.

Residents' interest in a replacement option, while the most viable in regards to energy utilization and the impact of repairs on substandard housing, required a confidence that their children would not be indebted as a result of upgrading. This is a key aspect of understanding the health impact of decisions related to upgrading housing and small repairs. It should be considered in marketing and outreach that Curry's target population of aged and low-income manufactured housing residents, with adult children fighting to survive in a challenging economic environment, are more concerned about their children's finances than their own health. As we consider the

healthcare costs associated with our aging population, providing them with safer living conditions with no-impact to their children is worthy of consideration.

## 5: Summary of Findings

### Characterizing Health Impacts

This HIA used the existing literature, current conditions data and information from stakeholders to make these judgments<sup>99</sup>. Tables 5 and 6 describe the HIA model of determining how current conditions, a literature review of existing evidence, and qualitative information collected from residents in the projected determine potential health impacts and the magnitude/distribution of those impacts on health. The people most impacted by replacement and or repair options for aged manufactured housing stock include:

- Renters of manufactured home (M.H.) lots
- Owners of manufactured homes
- The aged living in M.H.
- Their children
- Neighbors of the homes where communicable/vector borne diseases exist

The research team did not have the resources to determine the impact of the HSUI program on temporary or permanent jobs for the larger Curry County community based on potential demand for the HSUI program.

### Potential HSUI Program Health Impacts

Being able to manage existing conditions requires maintaining sound housing. The new housing repair and replacement program will provide more opportunities for elders to age in place and likely maintain their good health days and quality of life.

The research team expects that the new program could have potential positive impacts on indoor air quality, temperatures and structural integrity. This conclusion has the caveat that this is only likely where homes can be fully repaired and new replacement homes adhere to new specifications that have improved ventilation methods.

The research team predicts there to be small positive benefits of this program on the overall stress related to financial concerns of utility bills and stress related to debt. This is related to an uncertainty of the final financial packages available to residents based on either repair or replacement.

**Table 5: Key to interpreting effect summary table**

	<b>Likelihood of effect: how confident are we that this will happen to manufactured home tenants (owners or renters)?</b>	<b>Intensity of effect: how severe will the impact be to the people who get affected by the condition?</b>
?	<b>Uncertain:</b> evidence is insufficient or was not evaluated	<b>Uncertain:</b> effect is unclear or unknown
■	<b>Possible:</b> logically plausible with limited or uncertain supporting evidence	<b>Minor:</b> effect may contribute to poor health over time in affected people

■ ■	<b>Likely:</b> logically plausible with substantial and consistent supporting evidence	<b>Moderate:</b> results in annoyance, minor injury or risk of illness to affected people
■ ■ ■	<b>Very likely:</b> adequate evidence for a causal and predictable effect	<b>Severe:</b> results in moderate or severe injury, harm, or illness to affected people

**Direction of Impact** refers to whether the alternative will positively impact health determinants (+), negatively impact health determinants (-), or have no impact on health determinants (~).

**Populations Most Affected (Equity Impact)** involves identifying the possible distribution of impacts on already burdened populations.

**Table 6: Potential Health Effects of HSUI Program**

Health Outcome	Likelihood	Direction and Intensity of Effect	Populations Most Affected
<b>Aging in Place</b>			
Stress	■	? - ↓ Severity	Elderly M.H. residents
Social Cohesion	■ ■	↑	Elderly M.H. residents
Mental Health	■ ■	↑	Elderly M.H. residents
Maintain Quality of Life	■ ■	↑	Elderly M.H. residents
<b>Indoor Air Quality and Temperature</b>			
Respiratory Illness	■ ■ ■	↓ Severity	M.H. residents
Skin conditions	■ ■	↓ Severity, # of new cases	M.H. residents
Communicable diseases	■ ■	↓ # of new cases	M.H. residents
Heart disease	■	↓ Severity	Elderly M.H. residents
Arthritis	■ ■	↓ □ Severity	M.H. residents
Lead poisoning affects child development	■ ■ ■	↓ # of new cases	Children living in M.H.
<b>Home Structural Integrity</b>			
Injuries	■ ■ ■	↓ Severity, # of new cases	M.H. residents
Falls	■ ■	↓ Severity, # of new cases	M.H. residents
Vector Borne Disease	■ ■	↓ # of new cases	All residents
Fire related injuries, death	? - ■	↓ # of new cases	M.H. residents
<b>Utility Bills</b>			
Food security	? - ■	↓ Severity	M.H. residents
School attendance	? - ■	↓ # of new cases	Children living in M.H.

Debt-related Stress			
Stress	? - ■	↓ Severity	M.H. residents

## **6: Recommendations**

On July 26, 2013 HSUI stakeholders and interested manufactured homeowners were briefed on the findings of the HIA. They also unveiled the new name of the program: ReHome. They were presented with draft recommendations made by the research team initially vetted by Michael Mills of Oregon Solutions, Karen Chase of Regional Solutions, and Andrea Hamburg of the Oregon Health Authority. After the presentation, stakeholders were asked to review the recommendations, prioritize them, and provide additional recommendations. Below is a summary of the recommendations drafted during this meeting.

### **Indoor Air Quality and Structural Integrity**

- Promote replacement or repair options as a potential solution to poor indoor air quality.
- HSUI/ReHome team continue to work with manufacturers to implement specifications identified by the specifications committee to steadily improve ventilation, window, door, and insulation integrity to maintain longer life of a healthy indoor environment.
- Promote repair or replacement programs amongst healthcare providers for patients experiencing chronic conditions related to substandard housing (i.e. upper respiratory conditions).
- Promote repair/replacement options (including home assessment) for individuals seeking weatherization or utility rebate programs.
- HSUI/ReHome participant organizations provide educational resources on wood burning stoves and fire risks and carbon monoxide poisoning to residents.
- HSUI/ReHome participant organizations apply for grant funding for public education regarding home health and asthma/upper respiratory conditions.

### **Aging in Place/Stress and Debt**

As recommended by HIA researchers, baseline manufacturing standards need to delineate when a home is beyond repair. In the HSUI project, the specifications committee developed standards to facilitate aging in place, such as wider doorways and hallways for wheelchair accessibility and grab bars in bathrooms to prevent falls. The specifications committee consists of rehab specialists, the Manufactured Housing Association of Oregon, as well as representatives from NW Energy Works. In situations when repair is not viable, replacement options should be recommended. Additional considerations to alleviate the stress of relocating to a new home might include working with home-based health care workers or social workers to ensure elderly individuals are well supported throughout location.

- HSUI/ReHome participant organizations utilize a tool to categorize manufactured homes as repairable or non-repairable using existing tools from renter inspections (can and should apply to all applicants).
- HSUI/ReHome participant organizations partner with social workers and/or counselors to ease elder transition if home replacement is necessary. Example - artist create plaque of home that elder can keep as memento to honor memories.
- Manufacturers to implement recommended specifications for wider hallways, doorways, grab bars in bathrooms, etc. (in progress).
- HSUI/ReHome organizations involved in marketing and outreach of program includes information about debt potential for children and impacts on estate values.
- Marketing outreach materials should be clear and concise and focusing on referring people to NW Umpqua to provide a no “wrong door” strategy, meaning send them to the right place.

## Next Steps

The HSUI/ReHome leadership team continues to convene to troubleshoot barriers to successful program implementation and to utilize HIA finding to work with funders to support the financial incentives needed to truly make an impact on health related to substandard manufactured housing.

While it will be difficult to specifically associate a decrease in medical conditions amongst participants, a focus group will be held in May of 2014 among repair/replacement recipients to collect qualitative data regarding improvements in health outcomes related to indoor air quality/structural integrity, aging in place, and stress and debt. Oregon Solutions will convene a meeting during the summer of 2014 to make a final assessment of the outcomes of the HSUI/ReHome.

## 7: Evaluation

As part of the evaluation of HSUI pilot program, the following assessments will be utilized to monitor the ongoing success of the program and the benefits to local citizens. Due to limited resources in Curry County, no evaluation or monitoring plans are planned as part of the health impact assessment.

**Table 7: Assessments for the HSUI/ReHome Project**

Measures	Methods
Numbers of individuals inquiring about the program	NW Umpqua web-site, phone call data, as well as calls received by Curry County (collected via an excel website)
Numbers of individuals eligible for the program	NW Umpqua web-site, phone call data, as well as calls received by Curry County (collected via an excel website)
Numbers of individuals who participate in replacement or repair options	NW Umpqua spreadsheet identifying who qualifies for which program
Funding mechanisms utilized including loans, CDBG repairs, and grants from private funders	NW Umpqua Spreadsheet identifying who qualifies for which program and the funding source(s) utilized.
Numbers of individuals who receive home screenings based on referrals from weatherization service providers or other health and other social service entities	NW Umpqua spreadsheet tracking referral sources and recommended remediation.
Numbers of local contractors utilized to perform repair or replacement work as well as new jobs created	NW Umpqua spreadsheet tracking number of local contractors used as well tracking new jobs created from contractors in contractor invoices.

## Appendix: HIA Methodology

The primary aim of Health Impact Assessments is to improve population health<sup>7</sup>. The U.S. population has not yet reached its full health potential, despite major medical innovations and increased spending on health care. In Curry, for example, the most preventable causes of Emergency Room utilization involve falls for individuals over 65 and asthma for individuals under 55<sup>2,3</sup>. Health Status Assessment data, such as causes of illness and rates of obesity, seek to illuminate the correlations between built environments (such as our housing and neighborhoods), health behaviors, and social determinants of health (family environments, cultural norms, education, socio-economic status). Policy makers, public health practitioners, researchers, and planners recognize that multiple factors shape the conditions in which people are born, grow, live, work, and age. These conditions impact what options are available to communities. For example, it can be challenging for residents to choose daily physical activity or healthier food choices when they have broken steps that make it difficult for them to leave their home and limited disposable income lost to high electricity bills with which to purchase healthy food.

These factors, including personal behaviors and genetics, are known as “health determinants”. HIA practice focuses on understanding how specific policies or proposals will affect population health outcomes by acting on these health determinants.

**Table 8: Public Health and HIA Concepts**<sup>26,98</sup>

<b>Health Determinant</b>	Factors known to affect the health of an individual or a population, including: <ul style="list-style-type: none"> <li>· features of the social and economic environment, such as income and education</li> <li>· features of the natural and built environment, such as air quality, housing, and transportation access</li> <li>· a person’s individual characteristics and behaviors, such as genetic make-up</li> </ul>
<b>Health Impact</b>	An effect on the health status of an individual or population such as number of new asthma attacks from a proposal
<b>Health Outcome</b>	Changes in the health status of an individual, group, or population, which is related to a planned intervention, or series of interventions (as opposed to incidental exposure to risk), regardless of whether such an intervention was intended to change health status
<b>Health Equity</b>	The balanced distribution of health harms, health benefits, and health resources that affect health status among population groups.

<b>Health Inequity</b>	The disproportionate distribution of health harms, benefits and resources among population groups as a result of changeable social factors such as income inequality, differences in educational quality, differences in natural and built environmental conditions, differences in individual health behavior choices driven by factors beyond the individual's control, and unequal access to health care. Health equity is improved as these disparities are narrowed or eliminated.
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## **Screening: Purpose of the HIA**

In the screening phase, the research team, including the Local Public Health Authority and the Curry County Commissioner's staff determined that an HIA would benefit multiple audiences and the HSUI project with valuable information about the relationship of aging manufactured homes and health. The HIA could begin by informing lenders, funders, energy providers, manufactured home developers, and organizations involved in decommissioning or rehabilitation about the relationship between manufactured housing and resident health.

Owners of manufactured homes on privately owned or family leased land are a critical audience for this information. Largely low-income and living on fixed budgets, manufactured home owners are reticent to consider financing programs that would allow them to replace their manufactured home. They are often unaware that the money they would pay for a replacement with zero interest financing would be equal to their monthly energy savings. The research team learned in previous conversations with residents that they worry about costs associated with the removal of their manufactured home and costs associated with temporary relocation.

In an extensive feasibility study conducted in 2006, NeighborWorks Umpqua addresses these issues and demonstrates the effectiveness of dismantling and recycling old manufactured homes<sup>6</sup>. This HIA will inform outreach efforts to educate residents about why an upgraded home would contribute to their physical, economic, and environmental quality of life.

The research team determined that with a grant there would be sufficient resources to implement a desktop HIA. The Curry County Board of Commissioner's office received a grant from the Oregon Health Authority to sponsor the HIA. The HSUI project involves a series of stakeholder meetings to think through rehabilitating manufactured homes that include residents, lenders, funders, contractors and others mentioned above.

### **Who Conducted the HIA?**

Annette Klinefelter led the project, on an extra-duty contract with the Curry County Board of Commissioner staff. The term "research team" includes Annette and her advisor, Tia Henderson. Annette met with residents and community leaders during each stage of the HIA to gather input. The HIA did not have a steering committee. Two advisors contributed expertise: Andree Tremoulet, Ph.D. at Portland State University on

manufactured homes and Tia Henderson at Upstream Public Health on HIA practice. The project received funding from the Oregon Health Authority from the Centers for Disease Control and Prevention. The opinions expressed are those of the author(s) and do not necessarily reflect the views of funders or participants.

### Scoping: Components of the HIA

Following an initial scoping discussion for the HSUI project, Curry County chose to develop an application in September 2013 to apply to the Oregon Infrastructure Finance Authority (IFA) Community Development Block Grant funds (CDBG). Fiscal year 2013-2014 marks the beginning of funds allocated towards repair of manufactured homes in parks. Previously disallowed by the IFA, limitations on repairs in parks exclude a significant number of manufactured homeowners. In developing the scope of the HIA, the lead author met with community leaders and HSUI participants to determine how different aspects of the potential project could impact health (see table 11).

**Table 11- Draft scope of health determinants and health outcomes**

Health determinant	Health outcomes
<b>Repair only:</b>	
Ability to age in place	Mental health, stress, social cohesion, maintain quality of life
<b>Repair OR replacement:</b>	
Air quality	Respiratory illness (e.g. asthma, allergies, asbestos related), skin conditions, chronic conditions (heart disease)
Home structural integrity	Injuries, falls, communicable diseases from vectors, fire risk
Home temperature	Mental health, child development
Utility bills	Food security, child development, child school attendance
Stress	Blood pressure, mental health
<b>Replacement only:</b>	
House replacement stress from debt incurred by 2 <sup>nd</sup> generation	Mental health
<b>Not examined in this HIA:</b>	
Absenteeism	Child development related to lead poisoning, income security of tenants
Employment	Life expectancy
Use of CDBG funds by all programs	Health consequences of other housing related decisions
Landfill of decommissioned homes	Water and air quality in other communities

In Curry County, over 50% of manufactured homes are believed to be located in parks. While CDBG dollars cannot be used for home replacement, the HSUI successfully partnered with the USDA and lending partners to ensure home replacement is a viable option for qualifying residents who own the land upon which their home is located. This decision resulted in the HIA research team expanding the scope of the HIA to include both the health impacts of rehabilitation of manufactured homes and replacement of homes.

After the preliminary scoping exercise, the research team focused on health factors that had emerged in the screening and information gathered from existing literature on manufactured housing and its relationship to health. The group agreed to make modifications of the scope if they heard new information in conversations with stakeholders through the HSUI project. For example, the research team added the concept of aging in place as the HSUI project moved forward following the initial scoping exercise (see figure 1, introduced earlier in the report).

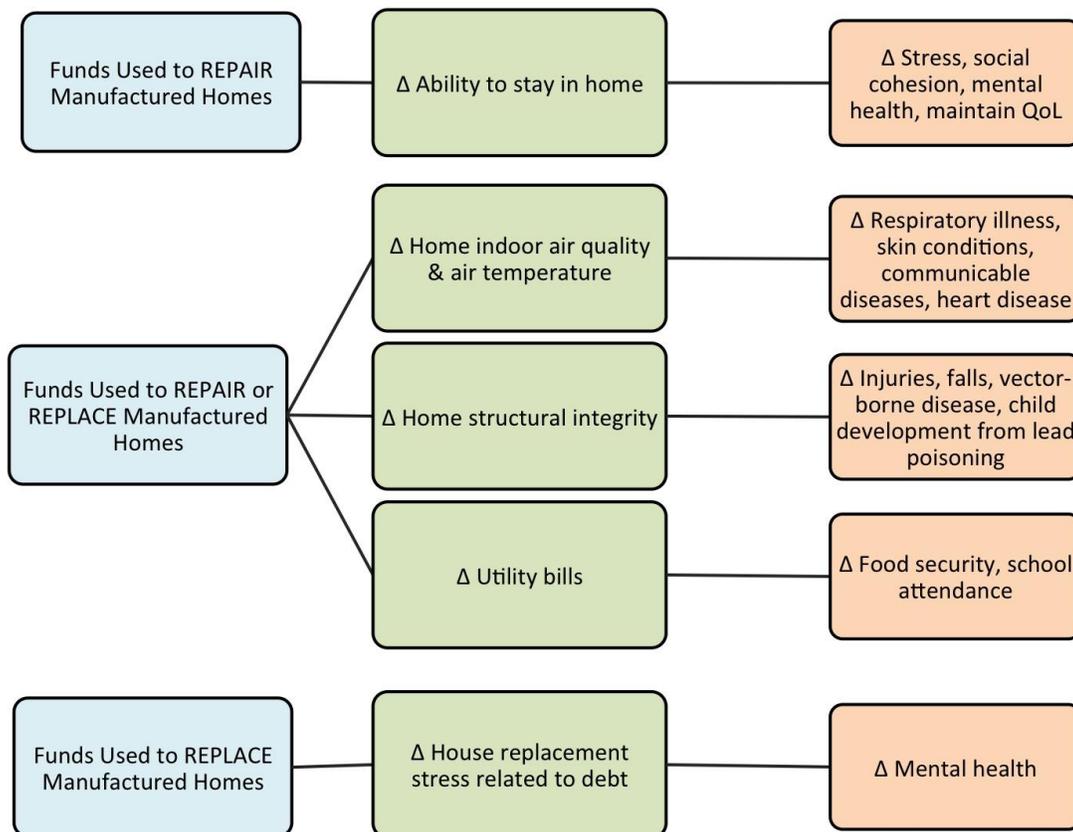


Figure 1 – Potential health determinant pathway diagram for ReHome project’s impact on public health

There are many health-related variables associated with manufactured housing

replacement and repairs including, but not limited to, the impact on aging populations, indoor air quality and structural integrity, stress of debt, job creation, community beautification, and environmental health. Due to limited staff resources and inadequate data in the realms of job creation, community beautification, and environmental impact, these variables have not been included in this study.

The report included findings and recommendations related to the health impacts of indoor air quality and structural integrity, aging in manufactured housing, and the stress of debt which may limit the participation in repair or replacement programs among those who need it the most. This HIA seeks to answer the following research questions:

- What are the current housing conditions in Curry County, and what are potential housing-related health issues for Curry County residents?
- What are the connections between aged manufactured housing stock and resident health?
  - How does substandard housing impact health?
  - How do manufactured homes impact health?
  - What role does manufactured housing play in facilitating aging in place?
- What are expected health impacts from replacing aged manufactured housing units compared to refurbishing these units?
- What are recommendations to address manufactured housing-related health issues in Curry County either to reduce negative impacts or maximize positive benefits?

**Table 9- Research questions**

Research Question	Methods to Answer Questions
What are the current housing conditions in Curry County, and what are potential housing-related health issues for Curry County residents?	Secondary data summary Resident workgroup meetings
What populations would be most affected by manufactured housing rehabilitation or replacement in Curry County?	Secondary data summary (county, state, federal)
How does manufactured housing affect health?	Literature review, stakeholder interviews, focus group and survey
How does sub-standard manufactured housing impact health?	Literature review
What role does manufactured housing play in facilitating aging in place?	Literature review, stakeholder interviews, focus group and survey

## Methods

Existing secondary data and literature review, serve as primary evidence for this HIA. Additional qualitative data is considered in this study as a secondary source of valuable

information to provide context for findings in the literature in combination with current conditions data. Homeowner as stakeholder involvement in this HIA occurred primarily by key informant interviews and focus groups conducted by Annette Klinefelter.

### **Literature Review**

In order to assess the potential health impacts of Curry County's Housing Stock Upgrade Initiative (HSUI) a review of the literature was performed to further support the assessment phase of this HIA. The review places emphasis on research and publications from peer-reviewed journals and reports compiled by government institutions and reputable organizations with expertise in the fields of housing and health. While this literature review is not intended to be exhaustive, it does attempt to objectively determine causal links between substandard manufactured housing and corresponding resident health outcomes.

This HIA used a quasi-integrated review, placing emphasis on research and publications from peer-reviewed journals in the study areas of health, housing, planning, social science, and environmental studies. Grey reports by private agencies, government institutions, and industry groups were also included in the body of evidence. Search terms particular to each research question were entered into a variety of electronic databases, including but not limited to Google Scholar, EBSCO, PubMed, Link360, and the Human Impact Partners Evidence Database. Search terms centered on "manufactured housing", however when evidence was lacking, "mobile home" or "trailer park" were also used and acknowledged in the synthesis.

In addition, some of the evidence used on aging in place was provided by Andree Tremoulet, PhD, a Portland State Faculty member knowledgeable in that topic. Quantitative and qualitative studies were included in the literature review with all articles written in the English language and ranging from published dates of 1985 to 2012. Only two articles used are of international origin while all others were compiled based on United States data and findings. The final evidence base for this HIA's literature review is supported by 45-50 literature sources. The studies were not graded for level of study strength or quality.

### **Secondary Data**

This HIA used existing secondary data from the U.S. Census, the U.S. Centers for Disease Control and Prevention, the Oregon Department of Education, the County Assessor's office, The Oregon Health Authority, and Curry County health care provider data. The main focus of this data is to understand the baseline situation for Curry County resident health conditions and the status of manufactured homes in order to understand how repairing or replacing older manufactured homes might affect resident health. Summary statistics are presented where appropriate; no additional integrative statistical analysis was conducted.

## **Stakeholder Engagement and Qualitative Information**

Given that there were two parallel interrelated projects happening at the same time that benefitted from stakeholder input, wherever possible, the research team used existing stakeholder feedback and methods from the HSUI in the HIA to avoid overwhelming individuals with requests for information and to maximize the use of existing resources. Qualitative data from key informant interviews included a focus group at a manufactured housing co-op, phone surveys from a random sample provided by the Curry County Assessor's office, and interested participants who called for additional information after media outreach. A total of 27 individuals participated.

### **1. Focus Group**

The Saunders Creek manufactured housing co-op in Gold Beach agreed to participate in an informal focus group where they were asked three questions:

- Do you believe your housing positively or negatively impacts your health?
- What are specific examples of health related issues have you experienced as a result of your housing?
- What role do manufactured housing communities play in keeping people healthy and able to age in their homes?

With the exception of 1 participant, all were over the age of 62. 10 of the 12 are disabled. The average annual income for this group was approximately \$16,654 with an average family size of 1.3. Of this group, 11 of 12 live in homes predating 1980. The mean construction date of homes is 1971.

### **2. Phone survey**

Phone surveys were conducted with 10 individuals in May 2013. A random list of manufactured home owners was provided by the Curry County Assessor's office with the names and addresses of manufactured home owners.

### **3. Media Outreach**

Curry's HIA has served as an ongoing opportunity to present data regarding manufactured housing to commissioners, regional builders associations, local media, and homeowners associations. Newspaper articles in the Curry Coastal Pilot and the Curry County Reporter directed interested residents to contact Curry County Economic Development. These individuals were contacted and their information is included in this qualitative data analysis.

### **4. Key Informant: Partnership with Environmental Health**

Environmental Health (EH) inspectors have a unique lens for the living conditions of manufactured housing residents. EH inspectors are responsible for inspecting RV facilities and countywide water systems. A workplace conversation with Curry Community Health's EH inspector excited her and during her inspections, sought out residents of substandard manufactured housing for outreach. She provided a phone

number to Annette Klinefelter, project lead. Six of the 27 participants of this qualitative data analysis were referred from the Curry Community Health Environmental Health program.

Data from all interviews was entered into a spreadsheet and analyzed based on the following:

- age of home
- annual income
- numbers of individuals living in the home
- race, gender, disability and female head of household status
- home conditions related to roof leaking, heating issues, plumbing issues, septic, well, broken windows, and other safety conditions

**Table 10- Survey and focus group respondent demographic summary**

Individuals	Home YB	Income	Avg Family Size	62+	Dslbd	Heat	Plmng	Roof	Hazard
2	1980+	13,461	2.3	1	1	1	1	0	2
15	1970+	16,313	1.8	8	4	8	6	6	13
10	1960-	6,675	1.5	9	9	1	3	8	7
Dslbd = Disabled, Plmng = Plumbing, Home YB = Age of home,									

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