

# HEALTH IMPACT ASSESSMENT

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Alignment of Affordable Housing Physical Inspection Policies of Ohio



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# EXECUTIVE SUMMARY

Affordable housing provides a platform to improve population health by increasing the availability of low-cost housing as well as ensuring a healthy built environment for vulnerable populations. Housing quality contributes to tenants' health status in a variety of ways. Healthy, affordable rental options, such as those funded through local, state, and federal monies, are an opportunity to promote health equity. This is especially important as health disparities are often seen in low-income populations, and have been linked to the availability of quality housing. Therefore, maintaining the quality of affordable rental options is necessary to ensure a positive lasting impact for the tenant and surrounding community.

## *Housing Quality and Safety*

Housing quality and safety have emerged as key factors impacting physical and mental health. High quality and safety standards are paramount because affordable housing serves vulnerable populations, including low-income renters, those with mental illness, those with developmental disabilities, and the formerly homeless. Housing quality issues include indoor moisture, visible mold, pests, lead paint, fire risks, and other factors that indicate general deterioration of maintenance. These types of issues are likely to be identified during physical inspections, and there is a substantial literature on these housing quality issues and associated health effects. Substantial evidence exists for an association between an exacerbation of asthma and other respiratory illnesses, chronic diseases, poisoning, and injuries and poor living conditions. Evidence for the effects of housing conditions on mental health was weak to moderate. The strongest evidence that changing housing conditions improves health was found for asthma and other respiratory diseases, lead exposure, and a few types of injuries.

## *Physical Inspections*

The physical inspections of affordable rental housing are a key mechanism to be certain that these properties meet quality and safety standards. These physical inspections follow the Uniform Physical Condition Standards (UPCS), which is a protocol designed to ensure that affordable housing properties are “decent, safe, sanitary and in good repair” while maintaining objectivity and uniformity in reporting standards. The UPCS physical inspections focus on exigent health and safety hazards. Since affordable properties rely on multiple layers of funding and subsidies from the U.S. Department of Housing and Urban Development (HUD), U.S. Department of Agriculture Rural Development (USDA RD), and Low-Income Housing Tax Credits (LIHTC) administered by state Housing Finance Agencies (HFAs), many affordable properties undergo multiple, yet similar, physical inspections to confirm compliance with program and funding requirements.

In response to declining state and federal funding, the White House Domestic Policy Council began a pilot program to reduce the frequency of physical inspections of affordable housing properties. This so called “physical inspection alignment” is being pilot tested in six states, including Ohio, and the Interagency Rental Policy Working Group is considering widespread implementation. This policy decision focuses on increasing the efficiency of the current physical inspection process; as such, the policy decision does not consider health

impacts of the resulting alignment process. Given the established correlation between housing and health, this Health Impact Assessment (HIA) was warranted to examine the health impacts of the proposed alignment of physical inspections.

This HIA was driven by five research questions:

<i>Question</i>	<i>Key Findings</i>
<p><b>1. Are there differences between various types of housing inspections and what proportion of inspections finds quality problems? Do the rates of problems differ depending on the agency doing the inspection?</b></p> <p>Since physical inspections are the only regular mechanism in place to detect housing quality issues, we first wanted to understand the baseline prevalence of health-related housing quality issues in the portfolio of affordable housing projects in Ohio. The implementation of each physical inspection protocol also varied across funding agencies, which might indicate the rates of health-related housing quality issues could differ. If a difference was detected, this may indicate that a reduced frequency of inspections could negatively impact some tenants more than others.</p>	<ul style="list-style-type: none"> <li>• 85.1% of physical inspections found at least one health-related quality issue.</li> <li>• Frequency of housing quality issues varied by funding agency, project size, and project age.</li> <li>• The most frequent housing quality issues were related to appliance and plumbing findings.</li> </ul>
<p><b>2. How many units have more than one inspection? If the number of physical inspections will actually decrease under the proposed policy, how much would disease rates change?</b></p> <p>If physical inspections were to occur less frequently, tenants living in affordable units may experience poor housing conditions. This may impact disease risk among vulnerable tenants.</p>	<ul style="list-style-type: none"> <li>• Though there is limited evidence that remediating housing quality issues improves health outcomes, the strongest evidence indicates that prolonged exposure to certain housing conditions will result in increased disease relates to asthma, lead and pesticide exposure, and some types of injuries.</li> <li>• Properties inspected by more than one funding agency frequently found the same housing quality issues.</li> </ul>
<p><b>3. Which of the current types of inspections used is the most health protective, based on available literature?</b></p> <p>The reduced frequency of inspections warrants careful consideration of the quality of the physical inspection tools currently in use. If only one agency conducted an inspection every three years, the inspection protocol selected would need to thoroughly review all housing quality issues to ensure a healthy and safe living environment.</p>	<ul style="list-style-type: none"> <li>• Prevalence of specific health-related violations (e.g., fire, pests, mold, appliances, air quality, ground fault circuit interrupter, accessibility, plumbing, and trip hazard) varied by funding agency, project size, and project age.</li> </ul>

<i>Question</i>	<i>Key Findings</i>
<p>4. <b>What evidence is there that physical inspections identify housing condition problems that would not be addressed by managers/owners in the absence of an inspection?</b></p> <p>If the frequency of physical inspections was reduced, the time until remediation of housing quality issues could be extended.</p>	<ul style="list-style-type: none"> <li>• Property managers' maintenance practices appear to vary and impact their ability to identify health-related housing quality issues in the absence of inspections.</li> <li>• During qualitative interviews, property managers and tenants identified physical inspections as an impetus for reporting housing maintenance issues.</li> <li>• Inconsistency exists among inspectors within and across agencies, complicating the extent to which housing condition problems could remain unidentified with fewer inspections.</li> </ul>
<p>5. <b>How disruptive are physical inspections for tenants?</b></p> <p>The physical inspection protocol requires inspectors to enter individual housing units multiple times per year to meet compliance requirements. Tenants living in affordable housing must give access to their home for these inspections in addition to other inspections required by owners and managers. Aligning the inspection process to reduce the frequency could offer an opportunity to reduce the impact on the resident while continuing to meet compliance regulations.</p>	<ul style="list-style-type: none"> <li>• Physical inspections have varying effects on tenants, according to how they maintain their unit and prepare for inspections, their physical abilities, and their attitude toward inspections.</li> <li>• Tenants with disabilities had the greatest difficulty preparing for physical inspections.</li> <li>• Tenants held differing and sometimes conflicting perspectives about physical inspections.</li> </ul>

### ***Methods***

The nature and differential impacts of housing-related health issues were assessed through a review of the existing literature, collection of Ohio physical inspection data from three agencies and secondary data sources, and key informant interviews with affordable housing property managers and tenants in Ohio. (See full report for more details)

# Physical Health Alignment: Housing Quality Issues and the Impact on Vulnerable Populations in Ohio



## ↑ Asthma and Respiratory Symptoms

**240,000 Young Children ≤ 5**

**Literature:** Strong impact on many based on 10+ strong studies. Asthma rates are twice as high among children below 200% of poverty level living in rental housing as compared to the population.

**HIA Findings:** Mold and pests were among the most frequently cited issues in physical inspections with 34.9% and 31.9% of projects with these findings, respectively. †

## ↓ Quality of Affordable Housing

**2.1 Million Low-Income Renters**

**Literature:** Strong impact on few or small impact on many based on fewer than 5 studies.

**HIA Findings:** The length of time until some housing quality issues are fixed may be extended depending on the property management practices. ‡



## ↑ Injuries (e.g. falls)

**346,000 Adults 55+ and 240,000 Young Children ≤ 5**

**Literature:** Strong impact on few based on 10+ strong studies.

**HIA Findings:** Trip hazards were frequently (16.8% of projects) cited in physical inspections. †

## ↑ Lead Exposure

**294,000 Low-Income Renters**

**Literature:** Moderate impact on medium number or strong impact on a few based on 10+ strong studies.

## ↓ Mental Health

**294,000 Low-Income Renters**

**Literature:** Moderate impact on medium number or strong impact on a few based on fewer than 5 studies.

## ↓ Housing Stability

**2.1 Million Low-Income Renters**

**Literature:** Small impact on a few based on fewer than 5 studies.

## ↑ Mortality (e.g. Fires)

**346,000 Adults 55+**

**Literature:** Small impact on a few based on fewer than 5 studies.

**HIA Findings:** Fire-related hazards were among the most cited (35.7% of projects) finding in physical inspections. Frequently, the citation was issued due to missing batteries in a smoke alarm. †

## ↑ Social Isolation

**346,000 Adults 55+**

**Literature:** Small impact on a few based on fewer than 5 studies.

## ↑ Chronic Disease (Excluding Asthma)

**346,000 Adults 55+**

**Literature:** Small impact on a few based on fewer than 5 studies.

## ↓ Cost

**Literature:** Potentially, save \$24 million within one year and \$111 million over 3 years.

**Source:**

[http://www.huduser.org/portal/aff\\_rental\\_hsg/RPWG\\_Conceptual\\_Proposals\\_Fall\\_2011.pdf](http://www.huduser.org/portal/aff_rental_hsg/RPWG_Conceptual_Proposals_Fall_2011.pdf)

† Results from quantitative assessment

‡ Results from qualitative assessment

↑ Increase

↓ Decrease

## ***Recommendations***

Based on the literature review and primary data analysis and stakeholder engagement, we provided recommendations to inform the key findings of this HIA which would minimize the negative health impacts that may be caused by a reduction in the frequency of physical inspections:

1. Implement a single standard across agencies, which is most likely to find health related quality and safety problems to optimize health. A standardized physical inspection tool will increase consistency in reporting and non-compliance remediation, which will improve health.
  - While funding agency inspection tools are based on the same standards, findings of non-compliance differed among agencies. A standardized, health protective inspection tool should include all housing quality issues, prioritize those that impose a more detrimental impact, and produce a summary measure to prioritize at-risk projects. Existing inspection tools could be modified to increase the health-protectiveness of the physical inspection alignment.
2. Establish ongoing training to increase the quality of physical inspection reports and to raise awareness of housing-related health issues among inspectors.
  - Physical inspection reports varied considerably within and across agencies; additional training would assist in streamlining execution of physical inspections themselves, and subsequently, the data gathered. Consistency in inspector training should enhance the reliability of data gathered in the real-world environments these individuals would encounter in the field.
3. Develop and implement a risk-based inspection agenda that focuses resources, streamlines inspection schedules based on housing and tenant characteristics, and is protective of adverse exposures and health. These include:
  - Decision makers should consider modifying the inspection schedule based on property and tenant characteristics. Modifying the schedule to account for property age and property size may minimize health risks, as these housing characteristics were independently identified as having a greater number of health-related housing quality issues. Though affordable housing tenants may all be considered to be vulnerable populations based on their income, subgroups within this population may be at an increased risk. The frequency of inspections should vary depending on:

### *Housing Characteristics*

- » The age of property
- » Number of units
- » Unfavorable inspection history

### *Composition of Tenancy*

- » Older adults
- » Families with children
- » Individuals with disabilities

These tenant characteristics should be taken into consideration when determining property inspection schedules.



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# INTRODUCTION AND BACKGROUND

Housing quality and safety have emerged as key factors impacting physical and mental health. Affordable housing, in particular, should meet high quality and safety standards because it serves vulnerable populations, including low-income renters (who report less than 80% area median income), those with mental illness, developmental disabilities, and the formerly homeless. Living in poorly maintained housing contributes to asthma, chronic disease, obesity, depression, and anxiety (Leventhal & Newman, 2010). The prevalence of these health problems is higher in affordable housing communities as compared to similar market rate multifamily housing (Howell, Harris, & Popkin, 2005).

Physical inspections of affordable rental housing ensure the rental unit, common areas, and grounds are fit for habitation. Many affordable properties undergo multiple, yet similar, physical inspections to confirm compliance with program and funding requirements. This is because affordable properties rely on multiple layers of funding and subsidies from the U.S. Department of Housing and Urban Development (HUD), U.S. Department of Agriculture Rural Development (USDA RD), and Low-Income Housing Tax Credits (LIHTC) administered by state Housing Finance Agencies (HFAs) and guided by Section 42 of Internal Revenue Service (IRS) code. As a result, each funding source triggers a different frequency and type of inspection.

Currently, a proposal to align the process of physical inspections for these entities is led by the Interagency Rental Policy Working Group (part of White House Domestic Policy Council), which aims to reduce the frequency of physical inspections of affordable housing properties (referred to here as the “alignment.” A more detailed description of the alignment can be found in this section under the subheading “What is the proposal being assessed?”). In response to declining state and federal funding, modifications were made to the physical inspection processes to enhance program efficiencies and reduce agency duplication. Specifically, the alignment aims to require one federal or state funding agency to inspect each property as opposed to all funding agencies associated with a property, thus reducing the number of inspections. This proposal would result in multiple agencies sharing physical inspection information to meet funding requirements.

In order to determine if the physical inspection alignment would be efficient, the proposed changes are being tested in a pilot project in six states, which started in 2010 and are ongoing. However, even if the changes are found to be efficient, they could potentially increase the length of time until poor housing conditions are repaired or decrease the scope of inspections, negatively impacting housing quality health and safety. To date, potential health effects and impacts on tenants of the proposed alignment were not being evaluated or considered in the alignment decision-making process.

## ***What is being evaluated in this Health Impact Assessment?***

This Health Impact Assessment (HIA) examined the health impacts of a proposed policy modification to reduce the frequency of physical inspections of affordable housing properties funded under HUD, USDA RD, or through the Low Income Housing Tax Credit administered by the IRS. This report explored the potential effects of an alignment of physical inspections on these housing-related health issues including the potential impact on the prevalence of respiratory disease, injury, and mental health.

This HIA focused on the efficiency of inspections, housing quality related to the alignment of physical inspection policies, and the potential health impacts on vulnerable tenants. For the purposes of this HIA, all tenants living in affordable housing were considered vulnerable, however, particular attention was focused on older adults (aged 55 and older), children and adults with disabilities, and children (birth to age 17). The five areas of consideration were driven by the following research questions:

**1. Are there difference between different types of housing inspections and what proportion of inspections finds quality problems? Do the rates of problems differ depending on the agency doing the inspection?**

Since physical inspections are the only regular mechanism in place to detect housing quality issues, we first wanted to understand the baseline prevalence of health-related housing quality issues in the portfolio of affordable housing projects in Ohio. The implementation of each physical inspection protocol also varied across funding agencies, which might indicate the rates of health-related housing quality issues could differ. If a difference was detected, this may indicate that a reduced frequency of inspections could negatively impact some tenants more than others.

**2. How many units have more than one inspection? If the number of physical inspections will actually decrease under the proposed policy, how much would disease rates change?**

If physical inspections were to occur less frequently, tenants living in affordable units may experience poor housing conditions. This may impact disease risk among vulnerable tenants.

**3. Which of the current types of inspections used is the most health protective based on available literature?**

The reduced frequency of inspections warrants a careful consideration of the quality of the physical inspection tools currently in use. If only one agency conducted an inspection every three years, the inspection protocol selected would need to thoroughly review all housing quality issues to ensure a healthy and safe living environment.

**4. What evidence is there that physical inspections identify housing condition problems that would not be addressed by managers/owners in the absence of an inspection?**

If the frequency of physical inspections was reduced, the time until remediation of housing quality issues could be extended.

**5. How disruptive are physical inspections for tenants?**

The physical inspection protocol requires inspectors to enter individual housing units multiple times per year to meet compliance requirements. Tenants living in affordable housing must give access to their home for these inspections in addition to other inspections required by owners and managers. Aligning the inspection process to reduce the frequency could offer an opportunity to reduce the impact on the resident while continuing to meet compliance regulations.

## *Significance of HIA*

The linkage between affordable housing quality and health has not been a central feature in the physical inspection alignment procedures used by state and federal agencies. A systematic consideration of health, broadly defined, has not been a part of the discussion among the physical health inspection alignment project partners. This HIA, conducted between January 2012 and November 2013 by the Ohio Housing Finance Agency and The Ohio State University College of Public Health, addressed this gap; further, it yielded a review of the level of health protection offered in existing inspection tools, and proposed recommendations to address potential health impacts on low-income tenants.

An individual's health status is attributable to factors that are within and beyond his or her control. While behavioral factors (e.g., diet, smoking status, and health screenings) are decisions that affect one's health, other individual-level factors (e.g., age, sex, and genetics) influence health in ways that one cannot control. Furthermore, external factors can directly or indirectly affect an individual's health status. These structural factors include:

- Social and economic factors (e.g., social cohesion and the means to purchase healthy food),
- Environmental factors (e.g., ambient air quality and workplace safety), and
- Policies (e.g., access to health care and quality, affordable housing).

Together, individual-level factors and structural factors—including social and economic, environmental, and policy-level factors—all contribute to the health status of individuals and populations.

HIA is emerging as a tool to help decision-makers better recognize the potential health consequences of non-health policy decisions. HIA is defined as a “systematic process that uses an array of data sources and analytic methods, and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects” (National Research Council, 2011). HIA has recently grown in popularity in part because they fill a critical need in policymaking.

**Table 1: HIA 6-step process**

<b>Screening</b>	Identify and describe the policy, program, plan, or project, including a timeline for the policy decision, the importance of the decision, and expected resource requirements for the HIA.
<b>Scoping</b>	1) Identify health effects to be addressed, affected populations and vulnerable groups, research questions, data sources, analytic plan, and data gaps. 2) Engage stakeholders in the HIA process and respond to issues raised by stakeholders.
<b>Assessment</b>	Collect and analyze data to describe baseline health status of affected populations, beneficial and adverse health effects of the proposal and alternative proposals, and engage stakeholders.
<b>Recommendations</b>	1) Identify proposals or actions that could be taken to avoid, minimize, or mitigate adverse health effects and maximize beneficial effects. 2) Propose a plan to identify stakeholders who could implement recommendations and to monitor and verify implementation.
<b>Reporting</b>	Clearly document the activities and results of the previous steps in the process and communicate to decision-makers, the public, and other stakeholders.
<b>Monitoring and evaluation</b>	1) Evaluate whether the HIA was conducted according to its plan and applicable standards. 2) Track changes in health indicators or implementation of HIA recommendations.

Source: National Research Council, 2011

In addition to identifying the potential health consequences of non-health policy decisions, the HIA practice serves to build capacity at the local and organizational level by fostering collaboration with stakeholders to design, conduct, and disseminate the HIA results and develop practical, feasible and actionable recommendations. By participating in the HIA, stakeholders learn to participate effectively in evidence-based decision-making that affects health. Conducting an HIA also enhances the abilities of decision makers to assess policy proposals, avoid unintended consequences and costs, and advance smarter, more cost-effective policies that promote health. Overall, an HIA should:

1. **Save costs.** By identifying how to minimize adverse health outcomes that lead to increased health services utilization and lost productivity, HIA promotes a long-term cost saving.
2. **Be flexible.** Whether policies are to be decided after one day of deliberation or years of debate, an HIA can be tailored to decision makers' timeframe. As a non-partisan, problem-solving forum, HIA can allow for more efficient resolution of policy differences and can serve to defuse conflicts between decision makers.
3. **Be proactive.** HIA proactively identifies and addresses potential concerns, thereby promoting smart economic development.

### **Why does the issue of aligning affordable housing physical inspections policies matter to health?**

While there is an established association between housing quality and health, a reduction in the frequency of physical inspections would potentially reduce agency duplication and the frequency of disruptions to tenants. Reduced state and federal funding make program efficiencies and agency duplication important; however, the proposed alignment could potentially increase the length of time until poor housing conditions are repaired or decrease the scope of inspections, leading to poor housing conditions. Living in poorly maintained housing contributes to asthma and other respiratory symptoms, neurological problems, injury, and mental health problems. A more detailed summary of the existing literature on the association between housing and specific health conditions can be found in Section 2.

### **What is the proposal being assessed?**

The White House Domestic Policy Council's Interagency Rental Policy Working Group was established in July 2010 to reduce agency duplication and enhance coordination between federal agencies. This group consists of affordable housing stakeholders and agency partners including HUD, USDA Rural Development, and the Department of the Treasury. These agencies provide overlapping financing and monitor federally funded housing projects. The proposed policy modification would reduce of the frequency of physical inspections triggered by the requirements of multiple federal funding sources used to develop the project.

In July 2011, the Interagency Rental Policy Working Group issued a report outlining the conceptual model for the physical alignment process. The physical inspection alignment project, led by USDA Rural Development staff, has six states (Michigan, Minnesota, Ohio, Oregon, Washington, and Wisconsin) participating in a pilot project. Each state is represented by staff members from the three core funding agencies. As part of the physical inspection alignment proposal, uniform reporting formats and the type of inspection tools are also under consideration. By November 2011, the Rental Policy Work Group launched a pilot project to assess the feasibility of the physical inspection alignment proposal. The aim of the pilot project was to test potential alignment strategies and estimate cost savings if the alignment was implemented on a national level.

In August 2012, the General Accounting Office issued a report outlining agency duplication among multifamily housing programs administered by HUD, USDA Rural Development, and Treasury. The GAO praised the efforts of the working group to reduce duplication. In August 2012, the working group held a conference and published an interim report. Efforts by the pilot project work group are ongoing as of the publication of this report. Formalization of some MOUs for the alignment have not been finalized and discussions about expanding the pilot project to additional states were suggested. There has not been a national implementation of the proposed alignment policy, which remains under active consideration.



### **What is the significance of this policy?**

The Rental Policy Working group used estimates compiled by U.S. Department of Housing and Urban Development, Office of Policy Development and Research (PD&R) in 2007 to determine the national savings that may be realized annually. These estimates indicated that the physical inspection process costs federal and state agencies \$45 million in staff time. In a time of austerity, reducing the frequency of physical inspections is estimated to produce significant financial savings to federal and state agencies. Estimates suggest that within one year of inspection alignment, agencies could save \$24 million. By reducing the frequency of inspections to once every three years, agencies would potentially accrue an additional \$111 million over a 3 year period. However, the current policy discussion does not address the impacts on tenant health due to a reduction in the frequency of physical inspections. A reduced frequency of physical inspections may result in poor housing quality due to a delay in fixing health-related housing quality issues.

While the discussion about agency duplication is a national one, the assessment of this HIA focused on Ohio's portfolio of housing projects to test the research questions. Ohio presents a unique case study because of the number of affordable housing properties throughout the state. Further, Ohio has one of the largest portfolios of affordable housing in the country, which includes a variety of property types including scattered site, senior, family, and permanent supportive housing. These factors make Ohio an optimal location to conduct an HIA on this policy alignment decision.

In 2011, Ohio had 2,443 affordable rental properties with U.S. Department of Housing and Urban Development (HUD), USDA Rural Development (RD), Low-Income Housing Tax Credits (LIHTC), and HOME funding sources. As a result, many affordable properties underwent multiple, yet similar, physical inspections to confirm compliance with program and funding requirements. Each funding source triggers a different frequency and type of inspection. For example, HOME funding requires an annual physical inspection, as compared to LIHTC properties, which require physical inspections at least once every three years. Table 2 presents the overlap of funding and subsidies in affordable rental properties in Ohio. Twenty-seven percent of Ohio properties reported multiple funding sources or subsidies. This equates to approximately 43,560 units. In Ohio, 26% of affordable rental properties had multiple sources of financing.

*Table 2. Overlap of Funding Sources in the Ohio Affordable Housing Portfolio*

<b>Funding</b>	<b>Number of Projects</b>	<b>Project %</b>	<b>Number of Units</b>	<b>Unit %</b>
TC Only	498	20.6%	37,904	25.0%
RD Only	231	9.5%	8,454	5.6%
HUD Only	1,031	42.6%	62,244	41.1%
HOME Only	30	1.2%	*	
TC, RD	103	4.3%	3,512	2.3%
TC, HUD	162	6.7%	20,381	13.4%
RD, HUD	34	1.4%	1,464	1.0%
TC, HOME	287	11.8%	15,185*	10.0%
RD, HOME	0	0.0%	0	0.0%
HUD, HOME	1	0.0%	8*	0.0%
TC, HOME, RD	21	0.9%	841*	0.6%
HOME, RD, HUD	0	0.0%	0	0.0%
TC, RD, HUD	4	0.2%	159	0.1%
HOME, TC, HUD	19	0.8%	1,340	0.9%
TC, HOME, RD, HUD	2	0.1%	70*	0.0%
<b>Total</b>	<b>2,423</b>	<b>100%</b>	<b>151,562</b>	<b>100.0%</b>

Source: Ohio Housing Finance Agency internal data;\*

\*Total number of units funded with HOME only dollars was not available and is not included in the total.

### ***Project Team and HIA Timeline***

The Alignment of Affordable Housing Physical Inspection Policies in the Ohio HIA was a collaborative project between Holly Holtzen, Ph.D. from the Ohio Housing Finance Agency, Office of Affordable Housing Research and Strategic Planning (OAHRSP), and Elizabeth Klein, MPH, Ph.D. from The Ohio State University, College of Public Health with generous support from the Health Impact Project. The OAHRSP is a housing finance agency based research center in partnership with OSU, John Glenn School of Public Affairs to enhance the ability to provide data-driven housing policies for low-moderate income families in Ohio. The project principals received technical assistance from Megan Sandel, MPH, MD from the National Center for Medical-Legal Partnership and Saqi Maleque Cho, Marjory Givens and Aaron Wernham from the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts. Additionally, the project team worked closely with the U.S. Department of Housing and Urban Development, USDA Rural Development, and the Coalition for Homelessness and Housing in Ohio. The HIA began in January 2012 and was completed in December 2013.

# HIA SCOPE AND METHODS

## *Scoping the HIA: Identifying Health Impacts of Interest*

During the scoping stage, the Research Team examined existing scientific and gray literature, meaning reports and data from sources other than academic journals, and obtained stakeholder feedback to identify the scoping pathways (see Appendix 2), research questions, assessment methods, and recommendations. To achieve the desired stakeholder engagement in the outcomes of this HIA, a HIA Stakeholder Advisory Group (see Appendix 1 for details) was formed and individual outreach was used. Stakeholders were identified as those individuals and agencies that have an interest in or would be affected by any changes to the frequency of affordable housing inspections.

### ***I. Identification of Stakeholders***

This HIA involved in-depth stakeholder participation during all phases of the HIA to ensure input from interested parties including federal and state agencies, tenant advocate organizations, tenants living in affordable housing, affordable housing property owners and managers, and non-housing agencies. These broad groups not only provided differing perspectives, but expertise about the affordable housing industry. Due to the diversity of stakeholders, several methods of engagement were employed. Stakeholder engagement took place using various methods to ensure equitable participation throughout each stage of the HIA through meetings, focus groups, and key informant interviews.

A brief discussion on the primary stakeholders is presented below.

- The key federal and state housing agencies involved in the decision-making process who were engaged during HIA include members of the White House Domestic Policy Council, Rental Policy Working Group, which comprises the Ohio Housing Finance Agency (OHFA), HUD and USDA Rural Development offices.
- The Coalition on Homelessness and Housing in Ohio (COHHIO) assisted during this HIA to engage affordable housing tenants. COHHIO assisted with stakeholder engagement through a network of approximately 350 community-based nonprofit organizations, affordable housing organizations, and homeless service providers throughout the state. Stakeholders were primarily engaged through structured interviews, to discuss the housing problems not indicated on inspection reports, verify the findings, and to obtain input on the proposed recommendations.
- Since many affordable housing properties serve populations with a variety of needs including homelessness, mental illness, and developmental disabilities, aging agencies were engaged to discuss the findings and recommendations that resulted from this HIA.

### **Stakeholder Input**

We developed research questions collaboratively with HIA stakeholders, including members of the Stakeholder Advisory Group, during the initial meeting in March 2012. During the scoping stage, stakeholders were engaged to clarify the housing inspection process, identify health conditions and affected populations not previously identified by the HIA research team, identify potential data sources, and to ascertain any related community

issues that could be addressed in this HIA. Each question was developed to address the policy decision-making process within Ohio, but, more importantly, the larger federal decision to align physical inspections. The focus on the state level includes two primary concerns: 1) the potential expansion of data sharing and scheduling of inspections and 2) coordinating, establishing procedures, and formalizing a model program. On the federal level, the primary concern is to inform the national deployment of the physical inspection alignment. The federal policy decision has not been finalized as of December 2013. The pilot alignment project is being conducted for another year. The key issues include the following: 1) Did “taking credit” for inspections (i.e. reduced frequency) save money; 2) For those at risk—what follow up was conducted by the state; and 3) Could the state share their inspection with HUD or RD?

Once the policy decisions were identified, the HIA Steering Committee drafted the research questions to guide the assessment stage. The assessment was conducted by staff from OHFA and OSU. The HIA Steering Committee met to discuss the research questions to guide the assessment stage of this HIA. The Committee identified variations between inspection agencies, a preliminary list of health impacts, and community-related issues. Also, members of the Steering Committee discussed soliciting other potential stakeholders, as needed throughout the assessment stage.

During the recommendations stage, the HIA research team engaged stakeholders to discuss the proposed recommendations. The research team also consulted the regulatory agencies involved in the Rental Policy Working Group to discuss the feasibility of adopting and implementing any recommendations. A draft of the final report was disseminated to the stakeholders for comment prior to the completion of a final HIA report.

## ***II. Literature Review: Specific Housing Conditions are Associated with Health Outcomes***

This section details the results of a systematic review of the scientific and gray literature related to the association between housing quality and health outcomes. The scope of the review focused on housing-related problems that were the responsibility of the owner or manager and likely to be identified and addressed in a physical inspection. Conducted in spring 2012, this literature review identified health effects of housing quality and safety issues that could potentially be impacted by required physical inspections. Relevant articles were identified by searching multidisciplinary research databases (e.g., Web of Knowledge), the internet, and references from identified articles and reports. Both peer-reviewed scientific and gray literature was included. All study designs were included (e.g., randomized controlled trials, longitudinal, observational). Example search terms were “housing and health,” “housing and asthma,” and “housing quality depression.” Because most of the connections between housing problems addressed in physical inspections and potential health outcomes have a large and well-established evidence base, we focused on systematic reviews and meta-analyses whenever possible, but we also reviewed particularly large or well-designed original research studies as appropriate.

## **Housing Quality and Chronic Diseases**

There is some evidence that housing problems, such as indoor moisture, mold, and pests, increase chronic disease and overall mortality rates. The Boyd Orr cohort study offered a unique opportunity to examine effects of poor childhood housing conditions on mortality later in life. Among more than 4,000 study participants, a lack of private indoor water supply was associated with coronary heart disease deaths, and poor ventilation was associated with higher overall mortality (Dedman, Gunnell, Smith, & Frankel, 2001). Analyses controlled for childhood and adult socioeconomic status.

Deficient general physical and mental health status was associated with a lack of satisfaction with or pride in one's dwelling among 528 Vancouver tenants living in neighborhoods with both high and low general mortality rates (Dunn & Hayes, 2000). In another study of adults in England, damp housing and an inability to keep warm were associated with having asthma or other longstanding illness, healthcare utilization, and self-rated general physical and mental health after controlling for many potential confounders (Evans, Hyndman, Stewart-Brown, Smith, & Petersen, 2000). Self-rated health status has been associated with overall mortality (Desalvo, Bloser, Reynolds, He, & Muntner, 2006; Idler & Benyamini, 1997).

Using data from the African-American Health Study, five different housing problems (cleanliness inside the building, physical condition of the interior, condition of furnishings, condition of exterior of building, and a global rating) were associated with increased odds of diabetes being present 36 months later among respondents previously without diabetes (Schootman et al., 2007). The pathways through which housing conditions independently influence the development of diabetes have not yet been identified; inflammatory markers were not associated with any housing conditions (Schootman et al., 2010).

## **Asthma and Other Respiratory Symptoms**

Each year, 7.8% of the U.S. population reports currently having asthma (Moorman, Zahran, Truman, Molla, & Centers for Disease Control and Prevention (CDC), 2011). Prevalence is higher among children less than 18 years (9.3%) compared to adults (7.3%). Among children, asthma prevalence is higher for black non-Hispanics (14.6%) and Hispanics (18.4%) compared to white non-Hispanics (8.2%); this disparity remains across income groups. Racial disparities are even more pronounced for morbidity and deaths due to asthma. Black children are significantly more likely than whites to be hospitalized and to die from asthma (Akinbami & Schoendorf, 2002). Black children living in poverty were more than twice as likely to have activity limitations due to asthma compared to other children, while white children not living in poverty were more likely to access outpatient healthcare settings for asthma (Akinbami, LaFleur, & Schoendorf, 2002).

Exposure to allergens such as mold, fungi, pests, and dust mites has consistently been related to more severe asthma symptoms among children with asthma, and may be associated with the initial development of asthma (Breyse et al., 2004; Le Cann et al., 2011). In a large case-control study, exposure to cockroaches and pesticides in the first year of life increased the odds of physician-diagnosed asthma by age five (Salam, Li, Langholz, & Gilliland, 2004).

Indoor moisture is one housing-related factor that increases the likelihood of these allergens (Krieger, 2010). In a recent meta-analysis of 33 studies of individuals age 3 or older, the presence of dampness and mold was associated with 30-52% higher rates of multiple respiratory health problems, including upper respiratory tract symptoms, cough, wheeze, current asthma, ever-diagnosed asthma, and the development of asthma (Fisk, Lei-Gomez, & Mendell, 2007). Another meta-analysis found that the presence of dampness/mold was associated with increased odds of respiratory tract infections and caused 8-20% of bronchitis cases, respiratory infections (excluding common cold), and respiratory infections (including otis media) in children or infants (Fisk, Eliseeva, & Mendell, 2010).

Pests are another source of allergens. Evidence suggests that pests are an on-going problem in low-income housing. In a survey of 358 public housing tenants in Gary, Indiana, only 19% did not report any pests; about half reported cockroaches and one-third reported mice (Wang, Abou El-Nour, & Bennett, 2008). Importantly, most tenants did not report pest problems to the housing provider; of 159 apartments with cockroach infestations identified in this study, only 22% had reported the problem to the housing provider. Thus, these housing quality problems would not be identified without a physical inspection. Among 60 public housing units in Boston, several common pesticides were found in all or almost all units and a banned pesticide was found in a majority of units (Julien et al., 2008). Even if the property management company uses integrated pest management, a holistic approach that minimizes the use of pesticides, a majority of tenants also attempt to treat pests themselves (Wang et al., 2008). Tenants have suggested that more frequent inspections may assist with pest control (Wang et al., 2008).

In addition to moisture and pests, other housing problems were associated with increased allergen levels. For example, holes in walls and ceilings were associated with mouse allergen levels, in a survey of low-income New York City apartments (Chew et al., 2003). However, tenant self-report of frequent mouse sightings was more closely associated with the presence of mouse allergen.

### **Housing Safety and Health**

Unintentional injuries that occur in the home are a particular concern for young children and older adults (Breysse et al., 2004; DiGuseppi, Jacobs, Phelan, Mickalide, & Ormandy, 2010). Each year in the U.S., approximately 18,000 die from unintentional injuries in the home (6.83/100,000 population) (Runyan et al., 2005a). Injury death rates were significantly higher for children less than one year of age and adults  $\geq 60$  years. Falls, poisonings, fires, and other burns accounted for more than three-fourths of all injury deaths. Falls were more common causes of death among older adults, while drowning and suffocation were more common among young children. It is important to note that most home injuries do not result in death. Yet, almost 13 million non-fatal unintentional injuries occur in U.S. homes annually, resulting in some type of medical advice or therapy (Runyan et al., 2005b). Falls are the most common cause of these injuries, with higher rates for children (0-14 years) and older adults ( $\geq 65$  years).

Observational data suggest that low parental socioeconomic status was associated with higher risk of unintentional injury deaths and hospitalization for injuries among children (Hippisley-Cox et al., 2002; Hong, Lee, Ha, & Park, 2010). Housing conditions account for at least part of the observed relationship between socioeconomic status and injuries among children (Shenassa, Stubbendick, & Brown, 2004).

Although very few studies have examined the relationship between mental illness and unintentional injuries, falls were the cause of injury among 46% of hospitalized patients with mental illness compared to 29% of other patients in one study, while motor vehicle crashes were more common among those without mental illness (Wan, Morabito, Khaw, Knudson, & Dicker, 2006).

### **Stress and Mental Health**

Better housing conditions have been associated with higher psychological well-being among adults (Sandel & Wright, 2006; Evans, Wells, Chan, & Saltzman, 2000; Evans, Wells, & Moch, 2003), although the effects of housing quality are often difficult to separate from other housing “comorbidities,” such as instability and general disarray (Suglia, Duarte, Sandel, & Wright, 2010). The relationship between housing conditions and mental health outcomes may be mediated by perceptions of control and physical health problems (Sandel & Wright, 2006; Shenassa, Daskalakis, Liebhaber, Braubach, & Brown, 2007) or social withdrawal (Wells & Harris, 2007). Concerns about housing quality have also been linked to increased negative affect and decreased life satisfaction among populations with severe mental illness (Kyle & Dunn, 2008).

At least one longitudinal study has examined changes in housing disrepair and psychological distress over time among low-income urban women with children (n=2,045), including a large proportion of public housing tenants (Burdette, Hill, & Hale, 2011). Although baseline levels of housing disrepair (e.g., leaky structures, broken windows, pests) were not associated with increased psychological distress two years later, increases in housing disrepair were associated with increased psychological stress over time (Burdette et al., 2011), suggesting that worsening of housing conditions over time increases stress among low-income tenants. One strength of this study was that self-reported housing disrepair was validated with interviewer observations. Evidence was not found for emotional support and self-esteem as mediators of the effect of housing disrepair on stress.

### **Social Isolation**

A large and well-conducted body of research has documented negative physical and mental health effects of social isolation on older adults (Hawton et al., 2011; Victor, Scambler, Bond, & Bowling, 2000; Shankar, McMunn, Banks, & Steptoe, 2011; Cornwell & Waite, 2009). Social isolation may affect health by influencing individual’s health behaviors or directly through physiological changes (Grant, Hamer, & Steptoe, 2009; Shankar et al., 2011).

Physical inspections may represent an opportunity for social contact for those individuals who may be otherwise socially isolated. Physical inspections represent very infrequent

interactions with strangers (e.g., interactions with housing inspectors 1-2 times per year) could contribute to social connectedness or, conversely, isolation. Although there are many related and overlapping concepts, social isolation has been defined as a “lack of meaningful and sustained communication, or as having minimal contact with either the family or the wider community” (Victor et al., 2000). Social isolation is typically measured as the number, frequency, or quality of contacts with family, friends, or, less often, neighbors (Pinquart & Sorensen, 2001). No studies of health outcomes were identified that measured infrequent contact with strangers as an indicator of social connectedness instead of or in addition to the typical measures. A few studies have examined social connectedness in the context of Meals on Wheels, which involves regular but fairly infrequent visits from volunteers who were not otherwise known to the recipient. In one study, recipients reported 17% more social contacts per month compared to a matched sample of non-recipients, but this measure was not linked to health outcomes (Millen, Ohls, Ponza, & McCool, 2002). Average monthly contacts were 97 for the intervention group and 83 for the comparison group. In a qualitative study of Meals on Wheels in Ireland, recipients described positive social benefits of the program despite volunteers spending very little time with them when delivering the meals (O’Dwyer & Timonen, 2008).

Studies have consistently found that the quality of social connections with family, friends, or others is more strongly associated with health-related outcomes than the quantity of social contacts (Pinquart & Sorensen, 2001; Segrin & Passalacqua, 2010). Although it does not directly measure health impacts of infrequent and informal social contacts, this body of evidence suggests that a few additional social contacts with strangers (i.e., inspectors) are unlikely to influence health outcomes.

### **Lead Exposure**

Infants, children, and fetuses are particularly at risk for negative effects of lead exposure (Breyse et al., 2011; National Research Council, 1993). For the past several decades, elevated blood levels have been defined as  $\geq 10$   $\mu\text{g}/\text{dL}$ . At this level, the following detrimental health effects have long been confirmed: problems with organ development in fetuses, cognitive function impairments and behavioral disorders in young children, and increased blood pressure in adults (National Research Council, 1993). Cognitive and behavioral changes are likely to be irreversible. At slightly higher lead levels, negative effects have been found on growth rates, birth weight, gestational age, hearing, and attention span.

Over the past several decades, blood lead levels among children and adults in the general population have decreased as the proportion of the housing stock built before 1950 decreased (Jacobs, Wilson, Dixon, Smith, & Evens, 2009). According to the most recent available NHANES data (2005-2008), less than 1% of children aged 1-5 years had elevated blood lead levels (defined as  $\geq 10$   $\mu\text{g}/\text{dL}$ ). While racial disparities remained pronounced through the 1990’s, exposure rates dropped significantly for black non-Hispanics in almost all age groups in 1999-2002 compared to 1991-1994 (Centers for Disease Control and Prevention (CDC), 2005). For example, 11.2% of black non-Hispanic children aged 1-5 years had elevated blood lead levels in 1991-1994 compared to 3.1% in 1999-2002.



Although the CDC recently changed the official definition of elevated blood levels from  $\geq 10$   $\mu\text{g}/\text{dL}$  to  $\geq 5$   $\mu\text{g}/\text{dL}$ , there is no safe level of exposure (Bellinger, 2008; Centers for Disease Control and Prevention (CDC), 2005). Levels of exposure below 10  $\mu\text{g}/\text{dL}$  have been associated with decreased intelligence among children even after controlling for other factors such as mother's intelligence, home environment, and perinatal factors (Jusko et al., 2008). A CDC working group on this issue concluded that available evidence supports the conclusion that low levels of lead toxicity cause cognitive deficits (Centers for Disease Control and Prevention (CDC), 2005). In January 2012, the working group recommended that the threshold for further evaluation be decreased to the 97.5th percentile in the population, which is currently 5  $\mu\text{g}/\text{dL}$ ; this standard has since been adopted (Centers for Disease Control and Prevention (CDC), 2012).

Today, most lead exposure occurs from lead-based paint in older homes; children either ingest paint chips directly or more commonly, ingest lead-contaminated dust (Jacobs & Nevin, 2006). Old windows are a key source of lead paint, and moving windows up and down creates more contaminated dust. Some experts are concerned that low lead exposure remains a critical—and largely unrecognized—health risk for children in part because extensive federal lead-related guidelines and regulations make people feel protected from this hazard (Sandel, Phelan, Wright, Hynes, & Lanphear, 2004). Physical housing inspections can help address lead exposure by ensuring that older affordable housing buildings are maintained and not deteriorating further.

### *Literature Review Summary*

This review identified numerous studies of associations between housing conditions that may be identified during physical inspections and health effects. Lead exposure is the least likely problem to be addressed in a typical physical inspection but was included because of the strong evidence base and historical significance. While the quality of evidence for the effects of housing conditions on mental health was weak to moderate, there was substantial evidence for associations with asthma and other respiratory illnesses, chronic diseases, poisoning, and injuries. The strongest evidence that changing housing conditions improves health was found for asthma and other respiratory diseases, lead exposure, and injuries. Additionally, subpopulations were identified that may have a higher risk for health effects of housing conditions. Specifically, black children have a significantly higher prevalence of asthma, lead exposure is primarily a concern for young children, and injuries are most common among young children and seniors. While chronic diseases affect older adults, there is evidence that housing conditions during childhood can impact their disease development.

**The strongest evidence that changing housing conditions improves health was found for asthma and other respiratory diseases, lead exposure, and a few types of injuries.**

### ***III. Data Collection and Analysis***

The previous section included the literature review conducted during this HIA to describe the nature and differential impacts of housing-related health issues within the existing literature. This portion of the HIA involved primary data collection for the purpose of a quantitative review of health-relevant housing issues documented through physical property inspections in a random sample of individual units of affordable housing. The Institutional Review Board at Ohio State University approved the secondary data collection of physical inspection reports and both interview research protocols. Individuals provided active consent to participate in the project. All interviews were digitally recorded and transcribed for analysis. A project staff member reviewed the transcription to identify and code the resulting key themes, separately for both types of key informants. Resulting themes were reviewed by the study research team in order to achieve consensus.

#### ***Property Inspection Review Procedures***

A systematic review was conducted on a stratified random sample of housing units using property inspection documents from affordable housing communities from 2007 through 2011. A random sample of properties was selected from the entire universe of HUD, RD, and LIHTC communities in Ohio in order to describe the scope of the housing-related health issues. From all available housing properties (n=2,823), a random sample using proportionate allocation was drawn from HUD, LIHTC, and RD communities. The resulting sample (n=370) is intended to reflect the proportional distribution of housing types based on 2010 data. A stratified random sample was chosen despite the fact that total number of properties within each agency portfolio was unequal; while this imbalance changes the probability of selection within each portfolio, the unweighted approach allowed for a greater overall sample size of inspection reports, and provided sufficient statistical power to detect differences desired to achieve the stated research questions. The most recent housing inspection (from the past three years) was selected for review and evaluation; a replacement property within that strategy was randomly selected if a current report was not available within the past 3 years.

A standardized rating sheet was developed and applied to all three housing types to describe the property issues, including housing quality and safety issues (referred to housing quality throughout this report) relevant to health outcomes, such as mold or water quality, air quality, injury risks, etc. Two project staff members were trained to conduct the systematic review of the property inspection reports to assure consistency in data coding. The following data fields were captured from the property inspection reports: property ID, property name, property address, year built, property management company, funding agency, property type, number of buildings, number of units, scattered site, inspection date, the Real Estate Assessment Center (REAC) score (if applicable), number of buildings inspected, number of units inspected, building number/name, unit number/name, vacant, fire violation, pest violation, mold violation, appliance-related violation, air quality violation, GFCI violation, handicap accessibility violation, plumbing violation, tripping hazard, other violations/issues. The research team and project staff held consensus meetings to review and recode ambiguous entries from inspection reports (Appendix 7).

The assumptions of this methodology are the physical inspections are complete and accurate and quality of inspector is consistent across property types. The limitations of the chosen methodology are the following: homogeneity of the housing types, infrequent measures (i.e. every 3 years in some cases), the magnitude and severity of health-related issues may be unclear in the inspection results, and health-related issues were present, but not visible during the inspection resulting in limited documentation of the problem.

#### *Case Study*

As illustrated in Table 1, there are an estimated 27% of Ohio's affordable housing properties with multiple funding sources. A case study was conducted using a purposive convenience sample of properties identified to have multiple funding sources that require multiple formats of inspection. From the original sample of OHFA, RD, and HUD properties, a small set (n=35) was taken; effort was made to include a balance of properties with all funder combinations (for example, HUD and RD, OHFA and HUD, etc).

Review of the property inspection was identical to the previously described procedures. Since multiple inspections were conducted, the sequence of inspections was documented to detail which agency conducted the first, second, or third inspection, as appropriate.

#### *Property Manager and Tenant Interviews*

Key informant interviews were conducted via telephone with affordable housing property managers. Ohio Housing Finance Agency provided a list of property managers, and a convenience sample of property owners/managers was identified. Property managers were recruited via email and phone. Semi-structured interviews were conducted by phone using 16 open-ended items regarding the affordable housing property, general maintenance, and physical inspections; the complete interview script can be found in Appendix 5. An estimated 8 to 12 interviews were targeted in order to achieve saturation on the identified themes. Interviews lasted approximately 15 to 30 minutes, and were recorded after active consent was obtained. No compensation was provided for the property managers.

Key informant interviews with tenants from affordable housing properties were conducted. Assisted by the Coalition on Homelessness and Housing in Ohio, tenants were recruited using flyers, email, and word of mouth. Eligibility criteria for participation were adults (age 18 or older) who currently or recently lived within an affordable housing property in Ohio. Semi-structured interviews were conducted face-to-face, using 14 open-ended items regarding the property general maintenance, experiences, and attitudes toward property physical inspections; the entire interview script can be found in Appendix 6. Tenants were given a small gift card (\$10 toward a local grocery company) in appreciation of their voluntary participation.

## ASSESSMENT FINDINGS

### *Secondary Data Collection: Affordable Housing Resident Demographics*

Project-based subsidized housing providers are required to submit basic demographic information collected during the tenant application process to HUD annually. The most recent available data, from 2012, were found through HUD Picture of Subsidized Households online database (<http://www.huduser.org/portal/datasets/picture/yearlydata.html#download-tab>). Table 2 presents demographic data from the 2012 Picture of Subsidized Households for all HUD programs. While not mutually exclusive from the 2012 Picture of Subsidized Household data, 2010 OHFA administrative data presented in Table 3 shows the demographic characteristics of tenants living in LIHTC projects in 2010.

*Table 3. Demographic Characteristics of Multifamily Subsidized Housing in Ohio<sup>a</sup>*

	All HUD Programs	LIHTC
Numbers of Units Available	225,171	76,556
Number of Residents	432,583	129,319
Very Low-Income <sup>b</sup>	97%	76%
Extremely Low-Income <sup>c</sup>	80%	56%
Family Type		
2+ Adults with Children	4%	12%
1 Adult with Children	38%	28%
All Persons in Household with a Disability <sup>d</sup>	21%	13%
Age of Head of Household/Spouse <sup>e</sup>		
≤24 Years	8%	16%
25-50 Years	48%	43%
51-61 Years	19%	16%
62+ Years	25%	27%
Race/Ethnicity		
Black	53%	50%
Hispanic	3%	2%

<sup>a</sup>Data from the 2012 HUD Picture of Subsidized Households and Data from the 2010 OHFA administrative data (<http://www.huduser.org/portal/datasets/picture/yearlydata.html#download-tab>).

<sup>b</sup>Defined by HUD as ≤50% of local area median.

<sup>c</sup>Defined by HUD as ≤30% of local area median.

<sup>d</sup>Any person who has a physical or mental impairment that substantially limits one or more major life activities, has a record of such impairment, or is regarded as having such an impairment

<sup>e</sup>Whoever is older.

## ***Baseline Community Health Profile***

### **A. Ohio Family Health Survey**

The Ohio Family Health Survey (OFHS) is the largest state-sponsored health survey in the U.S.; in 2008, the sample size was 50,944 households. OFHS is a telephone survey conducted with a stratified random sample of Ohio's non-institutionalized population. Random digit dialing was used to sample land lines with a supplemental cell phone sample, with oversampling for African Americans, Asians, and Hispanics. One adult and one child (if applicable) were randomly selected within each sampled household; the adult in the household who was most knowledgeable about the child's health responded to survey questions for the child.

Data from the 2008 OFHS Public Use File (PUF) (<http://grc.osu.edu/ofhs/datadownloads/index.cfm>) were used to estimate several health-related problems for affordable housing tenants. The survey did not include questions about receipt of housing subsidies. Therefore, the "focus population" was defined as respondents at 200% federal poverty level or below who also reported renting their home. The poverty cut-off was selected to be roughly equivalent to the average local area median in Ohio for "low income" households as defined by HUD, which is used to determine eligibility for many affordable housing units.

Tables 4 and 5 juxtapose various demographic and health-related characteristics estimates for the focus population to the rest of Ohio's population. Compared to the rest of the Ohio population, households in the focus population were significantly more likely to be female, African American, younger, and have only one adult (with or without children) (Table 4). Not surprisingly, children in the focus population were also more likely to be African American than the rest of Ohio population.

**Table 4. Demographic Characteristics of Renters Below 200% Federal Poverty Level Compared to the Ohio Population, Ohio Family Health Survey, 2008**

	Focus Population <sup>a</sup>			Rest of Ohio Population		
	Frequency/ Mean	Population Estimate	Weighted % <sup>**</sup>	Frequency/ Mean	Population Estimate	Weighted % <sup>**</sup>
<b>Adults</b>						
<b>Total Population</b>	<b>7,952</b>	<b>1,446,859</b>	<b>100</b>	<b>42,992</b>	<b>7,253,297</b>	<b>100</b>
<i>Gender*</i>						
Male	2,316	585,551	41	15,959	3,560,793	49
Female	5,636	861,308	60	27,033	3,692,505	51
<i>Race/Ethnicity*</i>						
White/Other	5,089	966,036	67	37,626	6,467,566	89
Black/African	2,257	394,404	27	3,414	555,760	8
American Hispanic	548	73,359	5	1,343	110,332	2
Asian	58	13,059	1	609	119,639	2
<i>Age*</i>						
18-24	745	314,436	22	1,416	784,556	11
25-34	1,257	317,076	22	4,005	1,143,954	16
35-44	1,328	262,810	18	6,587	1,322,424	18
45-54	1,552	206,625	14	9,101	1,372,213	19
55-64	1,307	165,255	11	9,378	1,271,414	18
65+	1,763	180,657	13	12,505	1,358,738	19
<i>Household Composition*</i>						
1 Adult, No Children	3,926	510,523	35	13,206	1,302,224	18
1 Adult, Children	1,477	234,815	16	2,260	277,308	4
2 Adults, No Children	1,281	335,266	23	18,200	3,424,582	47
2 Adults, No Children	1,252	362,521	25	9,254	2,238,310	31
<i>Number of Children in Family (Mean)*</i>	0.9	--	--	0.7	--	--
<b>Children</b>						
<b>Total Population</b>	<b>2,550</b>	<b>691,965</b>	<b>100</b>	<b>10,821</b>	<b>2,044,892</b>	<b>100</b>
<i>Gender*</i>						
Male	1,204	318,276	50	5,227	969,231	51
Female	1,150	312,854	50	4,991	941,791	49
<i>Race/Ethnicity*</i>						
White/Other	1,444	404,272	59	9,131	1,804,172	88
Black/African	782	237,339	34	879	158,442	8
American Hispanic	301	45,681	7	576	54,052	3
Asian	23	4,673	1	235	28,227	1
<i>Age*</i>						
<1	153	37,201	5	471	92,902	5
1-5	758	205,760	30	2,445	486,197	24
6-12	933	261,215	38	3,858	765,943	37
13-17	693	185,353	27	3,937	680,143	34

<sup>a</sup>Defined as ≥200% federal poverty level and does not own home.

\**p* < .05

\*\* May not add to 100% due to rounding

The focus population, including adults and children, had significantly worse health problems for every available health measure that was relevant to this project (Table 5). Most notably, the percentage of children with asthma was twice as high in the focus population compared to the rest of the state (17.0% vs. 8.7%). Among the focus population, asthma rates were slightly higher in urban versus rural counties (18.0% vs. 14.3%), but the difference was not statistically significant.

**Table 5. Health Characteristics of Renters Below 200% Federal Poverty Level (Focus Population) Compared to the Ohio Population, Ohio Family Health Survey, 2008**

	Focus Population <sup>a</sup>			Rest of Ohio Population		
	Frequency/ Mean	Population Estimate	Weighted % <sup>**</sup>	Frequency/ Mean	Population Estimate	Weighted % <sup>**</sup>
<b>Adults</b>						
General Health						
Excellent/Very Good/Good	4,511	942,061	65	35,316	6,160,622	85
Fair/Poor	3,411	501,438	35	7,592	1,083,584	15
Days physical health not good in past month (mean)*	6.7	--	--	3.5	--	--
Physical health not good $\geq$ 15 days in past month*	1,667	232,586	17	3,912	555,891	8
Days mental health not good in past month (mean)*	5.1	--	--	1.5	--	--
Mental health not good $\geq$ 15 days in past month*	1,073	198,470	14	1,658	270,560	4
Healthcare provider diagnosis of						
High Blood Pressure/Hypertension*	3,764	523,569	36	17,587	2,420,644	34
Heart Attack*	794	97,725	7	2,871	372,806	5
Coronary Heart Disease*	917	115,506	8	3,538	439,001	6
Stroke*	696	82,497	9	1,714	211,804	3
Diabetes*	1,712	213,658	15	5,870	767,616	11
Has a Disability <sup>b,*</sup>	2,815	420,801	29	5,733	813,697	11
<b>Children</b>						
General Health						
Excellent/Very Good/Good	2,227	599,007	93	10,123	1,890,854	98
Fair/Poor	170	44,143	7	227	45,054	2
Ever had asthma diagnosis	510	139,618	22	1,333	253,194	13
Currently has asthma	385	107,928	17	890	166,428	9

<sup>a</sup> Defined as  $\geq$ 200% federal poverty level and does not own home.

<sup>b</sup> Defined as needing long-term day-to-day assistance or special therapies; currently needing personal care, domestic and social/emotional assistance and having poor or fair health; or having 20 or more days of poor mental health in the past month.

\* $p < .05$

\*\* May not add to 100% due to rounding

## B. Boston Behavioral Risk Factor Surveillance Survey

No national health surveillance surveys include questions about receipt of housing subsidies. However, a question about living in public housing was added to the Boston Behavioral Risk Factor Surveillance Survey (BRFSS) in the early 2000's. Some health indicators from this survey were published in 2008 (Digenis-Bury, Brooks, Chen, Ostrem, & Horsburgh, 2008), comparing public housing recipients to other Boston city tenants. Table 6 includes similar health indicators to those analyzed above for Ohio. The prevalence of health problems was similar for Boston's public housing tenants and the focus population in Ohio, which adds credibility the health issues low-income housing residents face, and the health disparities in relation to other city tenants.

**Table 6. Health Status of Adult Boston Public Housing Tenants Versus Other City Tenants, Boston Behavioral Risk Factor Surveillance System, 2001 and 2003<sup>a</sup>**

	Public Housing Tenants		Other City Tenants	
	%	95% CI	%	95% CI
Fair/Poor Health Status	32.9	26.0 - 39.8	9.3	7.8 - 10.7
Hypertension (Ever Diagnosed)	26.0	28.7 - 43.3	17.4	15.5 - 19.3
Asthma (Current)	19.2	13.4 - 24.9	9.0	6.9 - 11.0
Diabetes (Ever Diagnosed)	13.8	8.3 - 19.2	5.3	4.2 - 6.5
Disabled for ≥ 1 Year	33.9	23.3 - 44.5	17.8	13.9 - 21.8
Felt Sad, Blue or Depressed ≥ 15 days in past month	19.6	13.4 - 25.7	6.5	5.1 - 7.9

CI: confidence interval; we can be 95% sure that this interval includes the true value in the population.

<sup>a</sup>Data reported in Digenis-Bury et al. (2008).



## **HIA Research Questions**

*Question 1: Are there differences between various types of housing inspections and what proportion of inspections finds quality problems? Do the rates of problems differ depending on the agency doing the inspection?*

### **I. Introduction**

The physical inspection process is designed to detect housing quality issues in affordable housing properties. In order to understand the health impacts of reducing the frequency of inspections, a baseline prevalence of health-related housing quality issues in the portfolio of affordable housing projects in Ohio was identified. Physical inspection protocols varied across funding agencies, which might indicate the rates of health-related housing quality issues would also differ. If a difference was detected, this may show that a reduced frequency of inspections might negatively impact some tenants more than others.

### **II. Background**

The most detailed data about housing conditions was collected as part of the American Housing Survey (AHS). The AHS was conducted with the same housing units every other year. A face-to-face or telephone survey was conducted with the current occupant; additional visual inspections were not conducted. Therefore, all information about housing conditions was self-reported. The AHS also included a series of questions to identify the subsidy status of each surveyed housing unit. Although estimates are available from the AHS for some metropolitan statistical areas, the most recent Ohio city was included in 2004. Therefore, national AHS data were preferred because they were more recent and provided better estimates of housing conditions in subsidized units.

Relevant housing condition data, using AHS data for rental units by subsidy status, were recently published (Walters, 2009); therefore, analysis were not repeated for this project. The analysis did not statistically compare the 2005 rates of housing conditions between subsidized and unsubsidized units, but instead revealed the change from 1997 to 2005 for different subsidy types. The only conditions for which rates increased more in private project-based subsidized units (excludes housing owned by a public housing authority) than unsubsidized were cracks in the foundation and missing roof materials. However, absolute rates for both of these problems remained very low.

### **III. Primary Data Collection Results: Ohio Affordable Housing Physical Inspections**

Housing conditions in affordable housing communities were determined through a systematic review of physical inspection reports in Ohio. Table 7 shows the descriptive characteristics of the stratified random sample of housing units gathered from HUD, RD, and LIHTC communities. The median age of properties was 25 years, and half of the projects were considered mid-size with 30 to 59 units. Only 4% of the projects had units that were not in one location and designed to be a scattered site project.

**Table 7. Descriptive Characteristics of Random Sample of Physical Inspections (n=370)**

		Total	OHFA N=125	HUD N=120	RD N=125
Average Property Age (Years)		25	10	37	28
Rehab	Yes	4%	0%	0%	4%
	No	96%	0%	0%	96%
Number of Units	1-29 Units	21%	22%	34%	44%
	30-59 Units	50%	30%	26%	44%
	60-100 Units	19%	48%	39%	13%
	101-559 Units	10%	49%	51%	0%
Scattered Site	Yes	4%	39%	56%	6%
	No	96%	28%	71%	1%

Source: 2007-2011 physical inspections from HUD, LIHTC, and RD communities

The majority affordable housing properties (85%) reported at least one health-related housing quality issue. Health-related housing quality issues included identification of a fire, pest, mold, appliance, air quality, ground fault circuit interrupter (GFCI), accessibility, plumbing, or trip hazard during the physical inspections for each unit. The presence of health-related housing quality issues varied by agency, with almost 91% of properties with a physical inspection conducted by HUD reporting at least one finding to a low of 79% of properties with a physical inspections performed by OHFA.

**Table 8. Percentage of Properties Reporting Health-Related Housing Quality Issues (n=370)**

Agency	%
All	85.1
HUD	90.8
OHFA	79.2
RD	85.1

Source: 2007-2011 physical inspections from HUD, LIHTC, and RD communities

The prevalence of health-related housing quality issues varied among all affordable properties. Table 10 presents the prevalence of health-related housing quality issues for all affordable housing properties included in the random sample by type. However, the magnitude and severity of the housing quality issues is not reflected in this table. The most frequent health-related housing quality issues were associated with appliance and plumbing findings. Pest, fire, and mold hazards were present in approximately a quarter of the affordable housing projects.

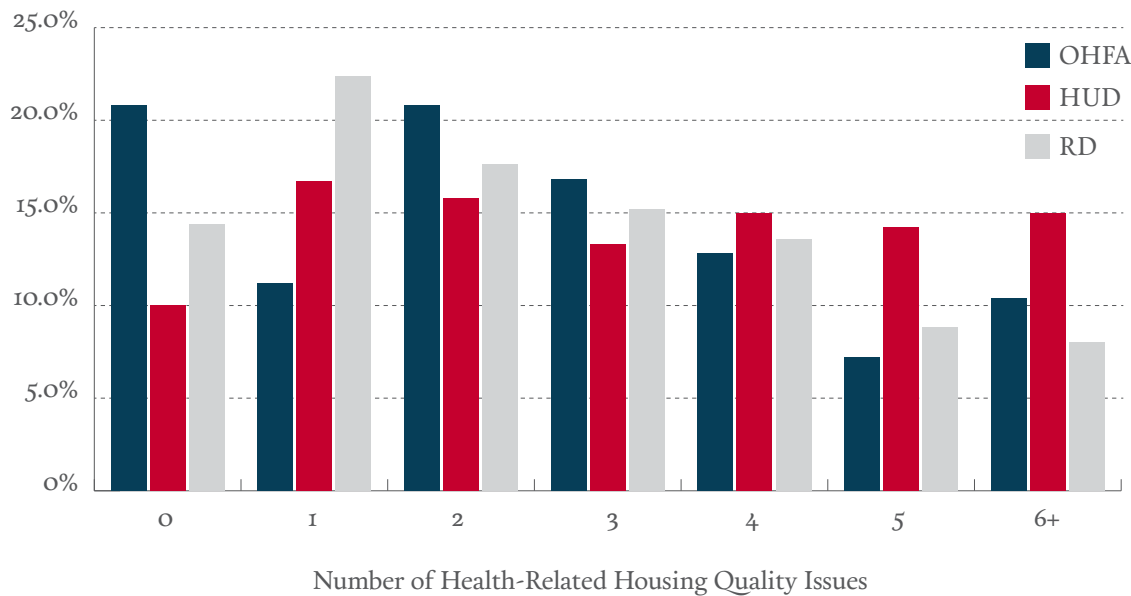
**Table 9. Prevalence of Health-Related Housing Quality Issues (n=370)**

Health-Related Housing Quality Issue	%
Pests	31.9
Fire	35.7
Mold	34.9
Appliances	54.6
Accessibility	24.1
Plumbing	48.6
Tripping	16.8
Air Quality	15.4
Ground Fault Circuit Interrupter (GFCI)	14.9

Source: 2007-2011 physical inspections from HUD, LIHTC, and RD communities

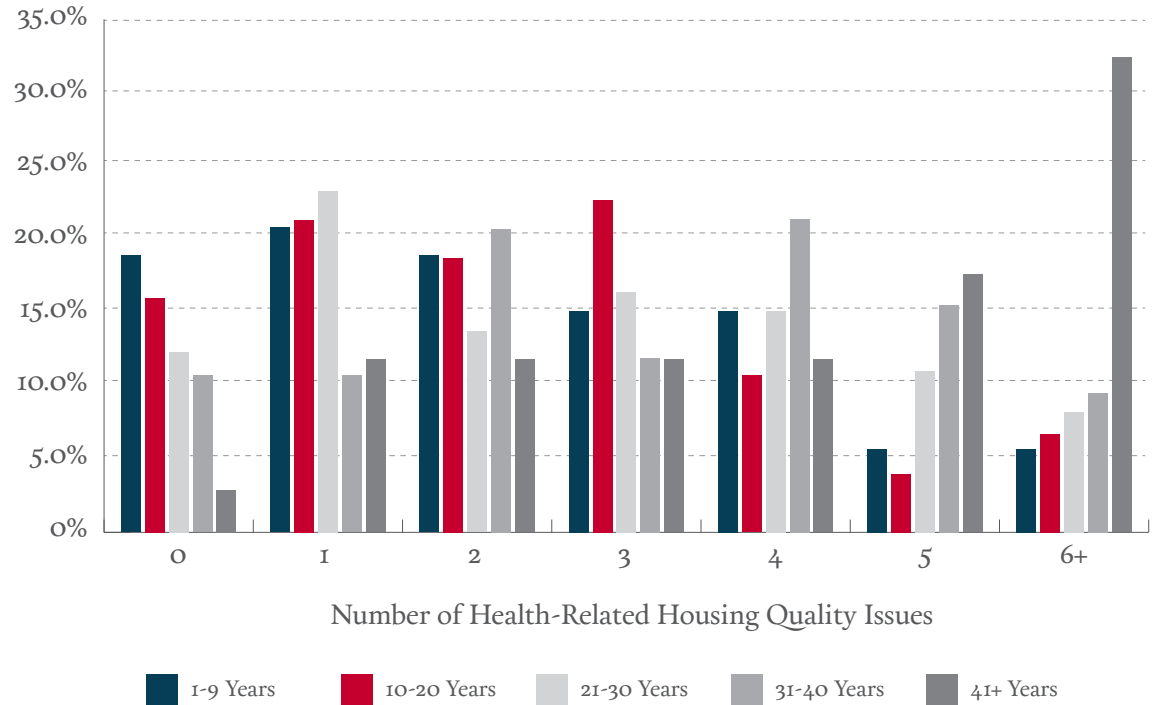
The prevalence of health-related housing quality issues in the random sample varied by funding agency. Figure 1 shows the number of health-related housing quality issues. Housing quality issues were found across all agency physical inspections.

**Figure 1. Health-Related Housing Quality Issues by Agency**



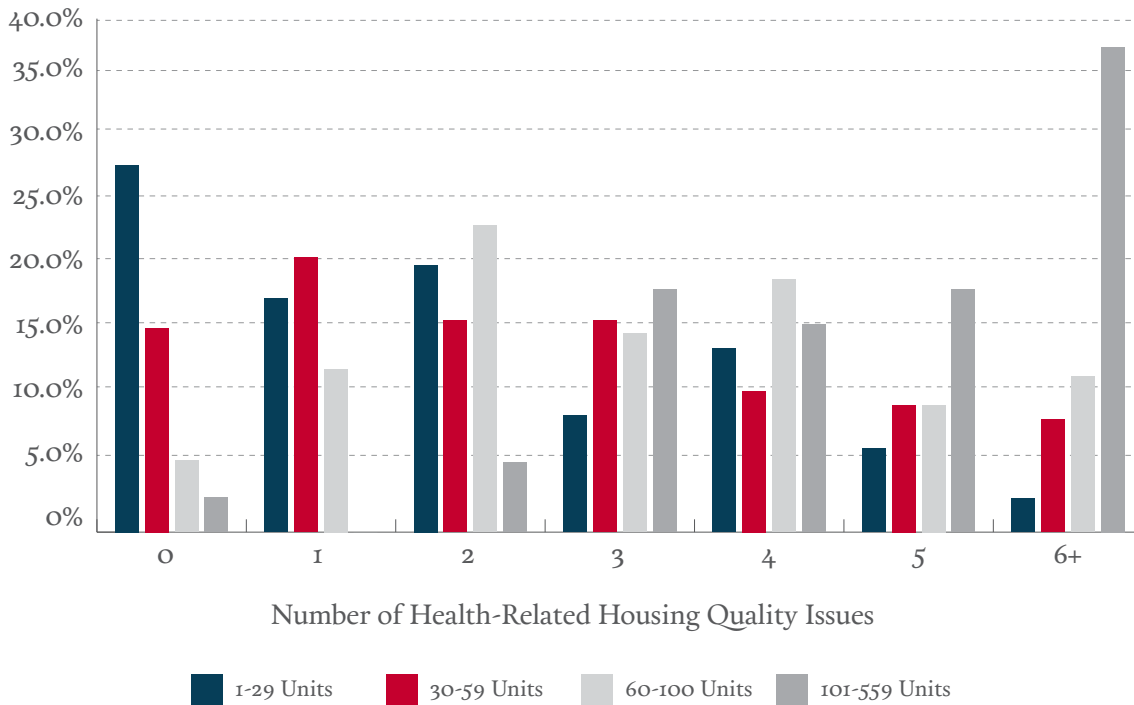
The prevalence of the number of health-related housing quality issues reported in physical inspections also varied by the age of the property. Figure 2 shows the number of housing quality issues by age of the property. Among older properties, aged greater than 40 years, 32% had more than six housing quality issues reported in the physical inspection report produced by each agency. This is in stark comparison to properties less than 10 years old, where only 6% had housing quality issues.

**Figure 2. Health-Related Housing Quality Issues by Age of Property**



The prevalence of the number of health-related housing quality issues reported in physical inspections also varied by the size of the property. Figure 3 shows the number of housing quality issues by the size of the property. Larger properties, those with more than 100 units, consistently had more health-related housing quality issues. Conversely, smaller properties, those with less than 30 units, were more likely to have no housing quality findings.

**Figure 3. Health-Related Housing Quality Issues by Number of Units**



#### IV. Conclusion

1. Physical inspections are an important tool housing funding agencies used to detect health-related housing quality issues. Housing quality issues were detected more often with the HUD multifamily inspection as compared to OHFA or RD. The number of housing issues and type varied not only by agency, but also the age and size of the property.
2. The specific health-related housing quality issues most frequently reported were appliance and plumbing issues, followed by pest, fire and mold hazards.
3. Older and larger affordable housing properties had more housing quality issues as compared to those built more recently or mid-sized housing.

*Question 2: How many units have more than one inspection? If the number of physical inspections will actually decrease under the proposed policy, how much would disease rates change?*

## **I. Introduction**

If physical inspections were to occur less frequently, tenants living in affordable units may experience poor housing conditions, which may impact disease rates among vulnerable tenants. A review of the evidence is provided below to determine how much of an impact a reduced frequency of inspections might have on disease rates.

### *Evidence that Mitigating Housing Problems Improves Health Outcomes*

Although there is strong evidence that many housing conditions are related to health problems, it is less clear that addressing identified housing problems leads to improved health. This section reviews the evidence of the impact of addressing housing problems on health-related outcomes. The strongest evidence is for housing conditions related to asthma, lead and pesticide exposure, and a few types of injuries.

A recent systematic review identified the following interventions to decrease allergens and other conditions most closely related to asthma symptoms: 1) multifaceted, in-home, tailored interventions to assess and address asthma-related triggers; 2) cockroach control through integrated pest management (to avoid pesticide use); and 3) eliminating sources of moisture and removing mold (Krieger et al., 2010). The latter strategy is most likely to be addressed as a result of physical housing inspections. Because mold can grow quickly and building materials can be compromised, it is important for sources of moisture intrusions to be identified and addressed as quickly as possible (Institute of Medicine, 2004). This requirement for timeliness may have implications for the proposed decrease in frequency of housing inspections. Remediation activities must safely address both the source of the intrusion, to prevent future microbial growth, as well as exposure to existing mold. Existing mold must be removed, if the surface is cleanable, or the material should be discarded. Extensive guidelines for remediation exist from multiple sources and are reviewed in the Institute of Medicine's 2004 report, *Damp Indoor Spaces and Health*.

Evidence is particularly strong for effectiveness of strategies to address exposure to lead and pesticides among children (Jacobs et al., 2010). For example, the use of integrated pest management decreases indoor exposure to pesticides, and residential lead hazard control strategies (e.g., paint stabilization, building component replacement) decrease children's blood lead levels (Sandel et al., 2010). However, the extent to which physical housing inspections could influence the use of these evidence-based strategies is unclear. For example, inspections do not typically include lead hazard assessments, in part because federally assisted housing providers already follow strict lead hazard control guidelines. Additionally, regulatory agencies may not be able to control how housing providers address pest problems (i.e., using integrated pest management versus pesticides).

The strongest evidence for housing-related interventions to prevent injuries is for functional smoke alarms and preset safe hot water temperature (Breysse et al., 2004; DiGuseppi et al., 2010). Physical inspections are very likely to impact the proportion of units with working smoke alarms; reviews suggest that this is one of the most commonly cited violations during inspections. According to the research evidence, interventions to improve smoke alarm ownership and function have typically included education, with or without provision of free smoke alarms, and are modestly beneficial (DiGuseppi, Goss, & Higgins, 2010). Home education programs for parents are also effective (Kendrick et al., 2007), with some evidence of increased effectiveness when program staff actually installs smoke alarms versus only distributing them (DiGuseppi et al., 2010). Distributing free smoke alarms without supplementary intervention activities is not effective; this is demonstrated by the fact that almost all units have smoke alarms but many are not currently working. The most effective intervention is the combination of education, equipment, installation, and home inspections, but the combination without installation may be more cost-effective (Cooper et al., 2012).

Strategies that improve safety of preset hot water settings include parental education and legislation requiring manufacturers to preset at a certain temperature (DiGuseppi et al., 2010). Many well-designed studies have found that parents who receive home safety education were more likely to have safe water temperatures among other home safety practices (Kendrick et al., 2007). However, research has not yet shown that these practices lead to decreased injury rates. Without gathering more information, it is not known if water temperature is assessed during physical inspections.

Although most general injury prevention interventions include educational components (Kendrick et al., 2007), physical inspections can only directly influence physical or structural aspects of the home environment. A recent systematic review concluded that there was insufficient evidence for the impact of physical modifications (e.g., installation of grab rails, stair gates, fireguards, lighting adjustments, removal of tripping hazards) to the home environment on rates of injuries (Turner et al., 2011). In another meta-analysis, the provision of safety equipment, in addition to home-safety education, among homes with children was no more effective in preventing falls or injuries than education alone (Kendrick et al., 2008). However, existing studies had limited designs and sample sizes, and studies have not been designed to isolate the effect of home modifications in multi-component interventions.

Other studies of general health outcomes from housing-related interventions have also identified challenges to disentangling the effects of multi-faceted housing interventions on a specific health outcome (Blakely, Baker, & Howden-Chapman, 2011). In a natural experiment with sophisticated statistical analyses, an intervention with subsidized housing tenants in New Zealand, that included housing improvements and referrals to improve access to healthcare and other social services, resulted in significantly decreased risk of acute hospitalizations for 0-4 and 5-34 year-olds, but not the 35 or older cohort (Jackson et al., 2011). Housing improvements included modifications to improve insulation and ventilation and to address overcrowding. Although the study design addressed most potential threats to validity of the study, it was not possible to determine which component(s) of the intervention caused the observed outcomes (Blakely et al., 2011).

## II. Primary Data Collection Results

To better understand if the frequency of physical inspections would change housing quality, a case study of 35 affordable housing properties with multiple inspections was conducted. The random selection of inspections resulted in few multiple inspections. In order to examine the presence of health-related housing quality issues among properties with multiple inspections, 35 properties from the initial random selection were identified as having another inspection. The second agency inspection was included in the case study described below. Table 10 shows the descriptive characteristics of the sample of projects with multiple physical inspections. The time between inspections ranged from less than six months to over a year. Frequently, the second physical inspection found health-related housing quality issues, regardless of which agency inspected first (see Table 11).

*Table 10. Descriptive Characteristics of Physical Inspection Case Study Sample*

		<b>N</b>	<b>%/Median</b>
<b>Agency Inspections</b>	OHFA	35	100.0
	HUD	12	34.3
	RD	23	65.7
<b>Number of Units</b>		35	48.0
<b>Age of Project (Years)</b>		34	35.0
<b>Rehab</b>	Yes	10	28.5
<b>Inspection Sequence</b>	OHFA, then HUD	8	22.9
	HUD, then OHFA	4	11.4
	OHFA, then RD	17	48.6
	RD, then OHFA	6	17.1
<b>Time Between Inspections</b>	< 6 Months	10	28.6
	6 Months - 1 Year	11	31.4
	> 1 Year	14	40.0
<b>Property Type</b>	Family	31	88.6
	Senior	4	11.4



*Table 11. Presence and Absence of Health-Related Housing Quality Issues in Properties with Multiple Physical Inspections*

	OHFA 1 <sup>st</sup>	HUD 2 <sup>nd</sup>	HUD 1 <sup>st</sup>	OHFA 2 <sup>nd</sup>	OHFA 1 <sup>st</sup>	RD 2 <sup>nd</sup>	RD 1 <sup>st</sup>	OHFA 2 <sup>nd</sup>
Fire	✓	✓	✓	✓	✓	✓	✓	✓
Pest	✓	✓	✓	✓	✗	✗	✓	✓
Mold	✓	✓	✗	✓	✗	✓	✓	✗
Appliance	✓	✓	✗	✓	✓	✓	✓	✓
Accessibility	✓	✓	✗	✗	✗	✓	✓	✗
Tripping Hazard	✗	✓	✓	✗	✗	✓	✓	✓
Plumbing	✓	✓	✗	✗	✗	✓	✓	✓
GFCI	✗	✓	✗	✗	✗	✗	✗	✗
Air Quality	✗	✗	✗	✗	✗	✗	✗	✗

Note:  
 + Presence of health-related housing quality issue reported in physical inspection  
 - Health-related housing quality issue not reported in physical inspection

### III. Conclusion

1. The physical inspection process is one tool to identify housing problems that lead to improved health.
2. The strongest evidence is for improvement through addressing housing conditions is related to asthma, lead and pesticide exposure, and a few types of injuries.
3. Additionally, a second physical inspection within approximately one year of the previous inspection continued to identify housing quality issues.
4. This suggests the physical inspection process does identify housing quality issues that may go unaddressed if it were not for the second physical inspection.

*Question 3: Which of the current types of inspections used is the most health protective, based on available literature?*

## **I. Introduction**

The reduced frequency of inspections warrants careful consideration of the quality of the physical inspection tools. If only one agency conducted an inspection every three years, the inspection protocol selected would need to thoroughly review all housing quality issues to ensure a healthy and safe living environment.

### *Existing Housing Quality Assessment Tools*

Experts have recommended that better enforcement of existing housing codes and coordination of assessment protocols could help to address housing conditions associated with health problems (Breysse et al., 2004). One major challenge is that a variety of assessment tools and protocols are currently used by different types of professionals in the U.S. (e.g., housing, public health) for varying purposes with minimal standardization and validation across tools (Jacobs, 2006). In order to answer the question of which inspection tool is the most health protective, the scope of each tool must be considered along with evidence of reliability and validity.

A recent qualitative review of housing quality assessment tools in the U.S. compared data collection methods and health-related housing hazards included in each tool (Jacobs, 2006). The following seven tools were identified: two tools which are used to determine whether housing units are qualified to receive federal housing subsidies (Public Housing Assessment System (PHAS) and Housing Quality Standards (HQS)); two tools designed primarily for survey or research purposes (American Healthy Homes Survey (AHHS) and American Housing Survey (AHS)); two tools designed to be used by environmental health practitioners for research or advocacy purposes (Hazard Assessment and Reduction Program (HARP) and the Community Environmental Health Resource Center (CEHRC)); and one tool for energy conservation and weatherization programs (National Energy Audit Tool (NEAT)). The HQS is most similar to the assessment tool currently used by HUD, based on the Uniform Physical Condition Standards (UPCS). For comparison purposes, the researcher categorized hazards into electrical, structural, moisture/mold, pests, ventilation, injury, fire, and miscellaneous. Compared to other assessment tools, the HQS included notably fewer injury hazards, such as sharp edges, uncovered shafts, drains, or wells. However, the HQS did include missing stairs/railings, which was one of the most severe hazards in the injury category. Other major differences between tools were that some included the collection of environmental samples or resident questionnaires in addition to visual inspections. Although this study is useful, it did not address the reliability or validity of the tools themselves.

The UPCS, which are currently used for physical inspections by both HUD and OHFA, were adapted from the HQS. The HQS and UPCS are both based on the statutory requirement that HUD housing be decent, safe, and sanitary, and they also require the housing to be in “good repair” (General Accounting Office, 2000a). The primary difference between the HQS and the UPCS is that the latter covers the entire property (e.g., site, common areas)

as well as the dwelling units. The UPCS also includes more specific lists of items to be inspected and defines what constitutes a deficiency for each item. When the UPCS were developed, HUD also revised its protocols for conducting physical inspections, including more consistent inspector training and oversight. The Real Estate Assessment Center (REAC) at HUD is charged with ensuring the physical inspection process is consistent and accurate.

After these revisions to the physical inspection process were completed in the late 1990's, the General Accounting Office (GAO) conducted a report to examine the reliability and appropriateness of the new physical inspection protocol. About one-third of inspections did not meet REAC's own standards based on independent physical inspections conducted by REAC staff after the initial inspection by the contractor. Additionally, the GAO identified limitations in REAC's quality assurance procedures, such as the non-random selection of inspections to review, lack of criteria on when reviews would occur in relation to the original inspection, and lack of documentation about how identified problems are addressed by inspection contractors.

**In summary, these results show that the REAC tool is reliable in ideal settings (e.g., REAC staff conducting the assessments) but there were problems with the reliability of a large minority of “real world” inspections.**

REAC responded to the recommendations and concerns identified in the GAO report, including improving the quality assurance plan and conducting an additional reliability study, with results reported in 2001 (Real Estate Assessment Center, 2001). The study involved REAC staff conducting parallel inspections to those conducted by contractors for 56 public housing properties in order to establish “real world” reliability of the tool (Phase I). These physical inspections use the same REAC system as that used on multifamily housing. Additionally, two REAC staff conducted parallel inspections at 112 randomly sampled public housing properties in order to establish ideal reliability and consistency of the protocol in a statistically valid sample (Phase II). Average differences in REAC scores were 12.5 for Phase I and 7.0 for Phase II. In Phase II, 50% of all scores had less than a five point differential between the two inspections and 90% had less than a 15 point differential. About one-third of the contract inspectors produced unreliable inspections based on the ideal reliability data generated in Phase II. In summary, these results show that the REAC tool is reliable in ideal settings (e.g., REAC staff conducting the assessments) but there were problems with the reliability of a large minority of “real world” inspections.

HUD's response to the 2000 GAO report has been documented as “implemented,” with the status of their response “closed” (General Accounting Office, 2000b), indicating the response was satisfactory. However, part of the response was to write semi-annual reports

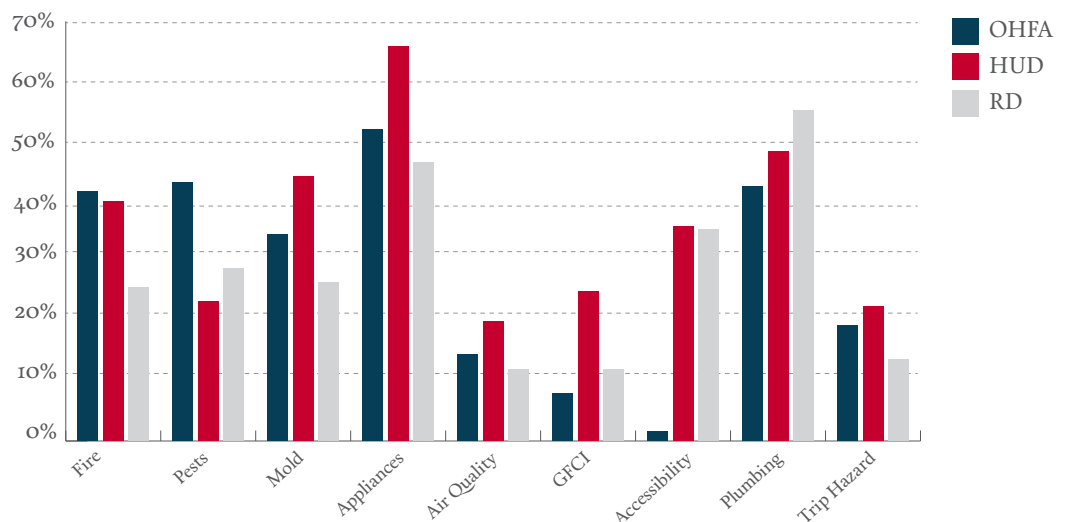
reviewing the REAC quality assurance program. No additional reports were located since the 2001 report described in the previous paragraph. Although no additional studies of the reliability and validity of the UPCS or REAC system were identified, reliability or validity has been evaluated for several similar tools developed to assess housing quality and conditions.

Increasingly, experts are calling for a consistent, comprehensive, validated housing quality assessment tool in the U.S. (Keall, Baker, Howden-Chapman, Cunningham, & Ormandy, 2010; Jacobs & Nevin, 2006). The two broad purposes for housing quality assessment tools are to: 1) monitor the prevalence of housing conditions to inform and evaluate policies, and 2) identify individual housing units in need of repairs or other interventions (Keall et al., 2010). Although current tools, protocols, and data analysis systems in the U.S. have been primarily developed for only one of these purposes (Jacobs, 2006), it has been suggested that the ideal housing quality assessment tool could serve both purposes simultaneously (Keall et al., 2010). It has also been recommended that such a tool would focus on structural aspects of housing that most directly impact health and safety rather than characteristics or behaviors of tenants (Keall et al., 2010). Of course, the ideal tool would also balance comprehensiveness with cost and time associated with administration. A review of existing housing quality inspection tools can be found in Appendix 4.

## II. Primary Data Collection Results

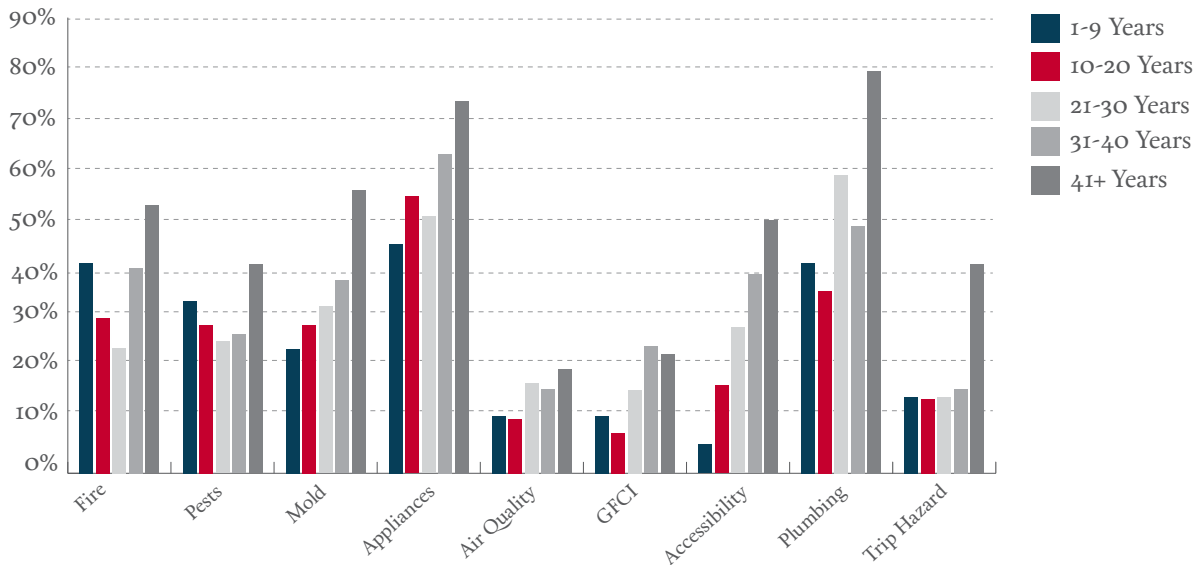
The research team identified specific housing quality issues recorded by each agency using the UPCS standards and agency-specific assessment tools. The prevalence of the type of issues reported in physical inspections also varied by funding agency. Figure 4 shows the type of housing quality issue by funding agency, from 2007 to 2011. Consistently, appliance and plumbing issues were identified the most across the different agencies. There seemed to be little concordance between the agency assessments of housing quality issues. For example, HUD and RD inspections identified accessibility issues more frequently as compared to OHFA.

*Figure 4. Prevalence of Health-Related Housing Quality Findings by Funding Agency, 2007-2011*



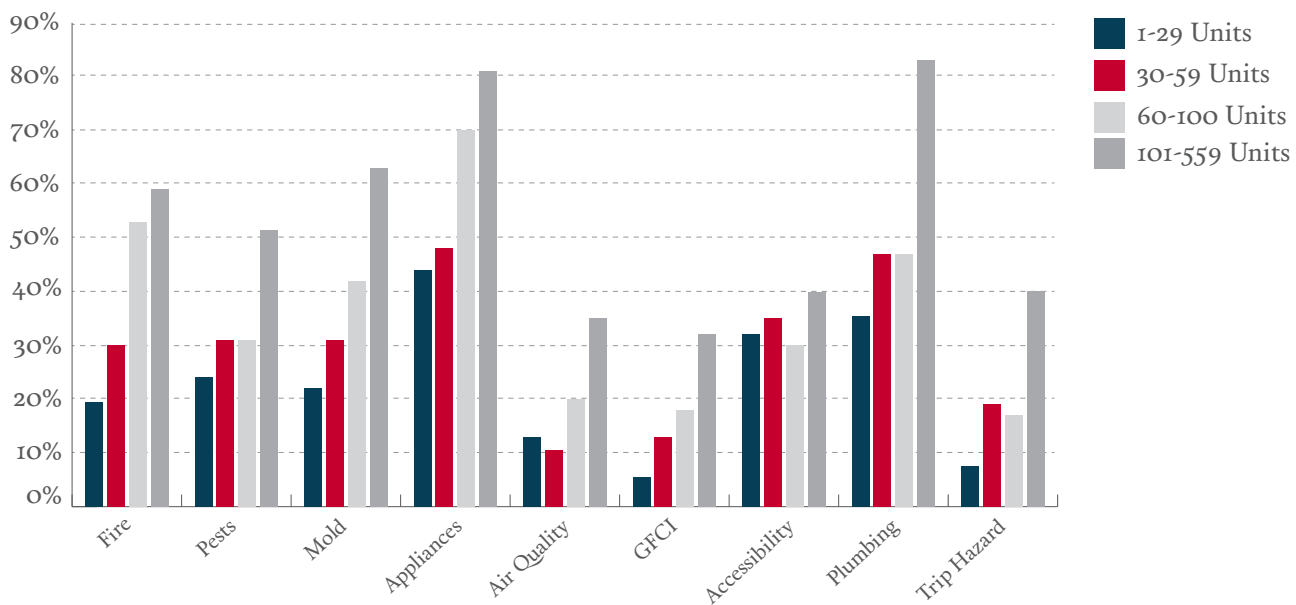
The prevalence of the type of health-related housing quality issues reported in physical inspections also varied by age of the property. Figure 5 shows the type of housing quality issue by the age of the property, from physical inspection reports from 2007 to 2011. Regardless of the instrument used, inspections of older properties frequently found more types of housing quality issues compared to newer properties. Properties over 40 years had a higher prevalence of fire, pest, mold, appliance, air quality, accessibility, plumbing, and trip hazards reported in the physical inspections.

**Figure 5. Prevalence of Health-Related Housing Quality Findings by Age of Property**



Properties with over 100 units consistently had the highest prevalence of housing quality issues. Figure 6 shows the type of housing quality issue by the size of the property.

**Figure 6. Prevalence of Health-Related Housing Quality Findings by Number of Units**



### **III. Conclusion**

1. If the frequency of physical inspections is reduced, the most health protective inspection protocol should be selected as part of the physical inspection alignment.
2. With the variety of existing housing inspection protocols available for use, consideration of which tool will be the most health protective to both monitor housing quality and identify areas for repair is necessary.
3. Further research should be conducted to examine the reliability and validity of the selected housing quality inspection protocol.
4. The review of existing physical inspections from HUD, OHFA, and RD demonstrated that the prevalence of health-related housing quality findings varied between agencies and by the characteristics of the property itself. While the inspections were all based on UPCS, the results differed on most of the health-related housing quality violations/issues. The physical inspection protocol used by HUD resulted in the identification of more housing quality issues as compared to either OHFA or RD. While this finding may be associated with the age and size of the property, the format of the physical inspection tool itself was more conducive to the identification of housing quality issues, due to the use of prompts. The prompts, or a detailed check list on the inspection forms, were not used by OHFA or RD.

*Question 4: What evidence is there that physical inspections identify housing condition problems that would not be addressed by managers/owners in the absence of an inspection?*

## **I. Introduction**

If the frequency of physical inspections were reduced, the time until fixing housing quality issues might be extended.

### *Maintenance of Private Project-based Subsidized Housing*

Walters (2009) provided a detailed summary of arguments related to economic incentives for subsidized housing providers to maintain (or not) their properties. According to economic theory, owners/managers of project-based subsidized housing have fewer incentives than unsubsidized rental providers to maintain their properties. This is because rent levels for project-based subsidized housing units are set by the government; providers cannot increase rent if they invest in property maintenance or renovations. Therefore, there is no direct economic reward for investing in maintenance and other upkeep. However, over the past several decades, several specific funding sources have been available specifically for maintenance and renovation of subsidized housing units, although more money has been directed to public housing than private project-based housing. Walters identified the LIHTC program as one funding source that has directly impacted the quality of private project-based housing, because about one-third of LIHTC projects have been specifically for renovation, and three-fourths of these projects also receive other federal housing subsidies. He also identified the Mark-to-Market (M2M) program, which includes about one-fourth of private project-based properties and provides extra subsidies for repairs and improvements. Another incentive for private project-based providers to maintain their properties is that they will still own the properties at the end of the use agreement and can transition it to market-rate renting at that time.

After outlining the evidence for and against the presence of economic incentives for private subsidized housing providers to maintain their properties, Walters (2009) used data from the American Housing Survey (1987-2005) to examine whether subsidized housing units actually deteriorated more quickly than unsubsidized rental units. Overall, analyses did not show any support for higher rates of deterioration among subsidized units compared to unsubsidized. In fact, the condition of both subsidized and unsubsidized units was fairly stable from 1997 to 2005, with the largest deterioration among voucher units. In 2005, the most common problems in private project-based units were evidence of rodents (10.7%), inside water leak (10.2%), and cracks in the floor (8.5%). The proportion of tenants who were dissatisfied or partly dissatisfied with property maintenance also did not differ between project-based subsidized (27.2%) and unsubsidized (27.1%) units, although it was higher for public housing (30.3%) and voucher (32.5%) units.

This literature has some limitations. For example, the subsidy status and type was self-reported, which has been shown to be less accurate than administrative data (Shroder, 2002). Additionally, units with funding from LIHTC were only represented as subsidized

units if they also received other federal subsidies (that were apparent to the tenant), and LIHTC units could not be distinguished from other private project-based subsidies. A final issue is that subsidized units could not be further divided into non-profit versus for-profit owners. Several researchers have noted that economic incentives for the development and maintenance of affordable housing vary for these two types of institutions (Deng, 2011; Ellen & Voicu, 2006). Non-profit agencies have less to gain from avoiding ongoing maintenance (Ellen & Voicu, 2006). Empirical evidence that positive neighborhood impacts of housing projects are maintained longer for non-profit compared to for-profit developers contribute to this argument (Ellen & Voicu, 2006).

Tenants' incentives (or lack thereof) to help maintain their unit present another issue related to maintenance in the absence of inspections. Similar to owners/managers of subsidized housing units, tenants do not typically receive direct economic benefits from contributing to property maintenance and upkeep (Miceli, 1992). Additionally, the tenant's maintenance practices cannot be enforced directly, while the housing providers' activities can. Interestingly, it is possible to design programs to create tangible incentives for tenants to

help maintain their units or properties. For example, a non-profit in Cincinnati, Ohio has a renter equity program that provides "equity credits" to tenants who cooperatively participate in the care and management of their housing and pay their rent on time. The credits can eventually be converted to a cash payment through the loan fund.

**Specifically, properties that were managed by a preventive maintenance schedule may be less affected by a decrease in physical inspection frequency because site maintenance was not triggered by an approaching inspection.**

## **II. Primary Data Collection Results**

### *Property Managers' Preparation for Inspections*

One of the central themes that emerged from key informant interviews with property managers was that property managers utilize two main approaches to prepare for physical inspections by funding agencies: following a preventive maintenance schedule or pre-inspecting their properties. While some property managers used both of these methods (e.g., a regular maintenance schedule with a pre-inspection before a funding agency does their inspection), most property managers relied on one method to prepare for physical inspections. The distinction between these preparation methods indicated that some property managers might be more likely than others to observe a housing condition problem in the absence of an inspection due to their property maintenance routine. Specifically, properties that were managed by a preventive maintenance schedule may be less affected



by a decrease in physical inspection frequency because site maintenance was not triggered by an approaching inspection. A majority of property managers interviewed described that they followed a preventive maintenance schedule and had few, if any, preparations due to an upcoming inspection. A property manager with HUD, OHFA, and RD funding summarized this point: “A good portion of what we do is self-scheduled maintenance. So there is no particular effort for the inspection.” Similarly, another property manager with HUD funding described how there was no formal preparation for inspections: “Typically we don’t have to prepare because we think that we do a good job maintaining the properties on a daily basis routinely [sic] anyway. So we don’t take any special...acts when we understand there is an inspection coming.”

Properties managed without a preventive maintenance schedule may be more susceptible to housing condition issues that would not be corrected in the absence of an inspection. Property managers who did not mention following a preventive maintenance schedule instead relied on pre-inspecting their properties before a funding agency’s inspection. As a property manager with HUD and OHFA funding described, these pre-inspections are intensive, but the effort can vary depending on the agency that will be inspecting the property: “It depends on who’s coming. If a REAC person is coming, we do an entire pre-REAC, going into every unit, every storage room, every common area, and we kind of do the REAC ahead of time ourselves... if there are any work orders from that pre-REAC, we ensure that those all get finished before they get there.” The same property manager continued, “For a REAC it’s [the preparation duration] probably about four weeks. For the others we don’t prepare, really. It’s just a matter of getting the notice out to tenants.” The consequences of failing an inspection were commonly listed as motivating factors for inspection preparation efforts, with most property managers identifying the consequences of failing a HUD multifamily inspection as the most serious. Because of this and the stricter protocol, the most thorough pre-inspection efforts were generally made for HUD multifamily inspections, meaning that the extent to which housing condition problems would go unnoticed in the absence of inspections could depend on which agency does the inspection.

Property managers were asked how they foresee their property maintenance and inspection preparation activities changing if there were fewer inspections, and most speculated that there would be no change. In some cases, the property manager reiterated that their preventive maintenance schedule would prevent a change in how their properties were managed and how they prepared for inspections. Other property managers who pre-inspected their properties before physical inspections suggested that they would adopt a more proactive approach to maintain their properties. A property manager with HUD, OHFA, and RD funding described how her property maintenance would change: “I dovetail my reviews of the properties with the inspections that are scheduled, and if they did them in less times then I would just schedule my own.” Some property managers stated that they would likely make fewer site visits if inspection frequency was reduced, but they also speculated about how they would maintain their properties with fewer site visits and fewer pre-inspections. A property manager with HUD and OHFA funding shared how he might increase tenant outreach to maintain the property: “If we haven’t heard from anyone we may make some phone calls just to double check, you know, because usually something goes

wrong, you know something minor. So we haven't heard from anybody for quite a while, so we might give them a phone call." Other property managers suggested that a decrease in their frequency of pre-inspections would give them more time to complete other property management tasks.

### *Housing Maintenance Issues*

Tenants' reporting of housing condition problems impacted property managers' abilities to resolve issues in the absence of an inspection. To identify which housing condition issues tenants might be living with for a longer duration in the absence of inspections—and what impact these issues could have on tenants' health—property managers were asked to discuss housing maintenance issues that were not reported by tenants. Common problems that go unreported included plumbing issues like leaks and running water, beeping smoke detectors, damage caused by the tenant, pests, and problems that did not affect the daily life of tenants, like one malfunctioning burner, cracked switch plates, or a broken light fixture that the tenant does not use often. Property managers offered speculation on the reasons that tenants did not report these issues. Some supposed that tenants did not feel financial responsibility for utilities or property upkeep, tenants judged the problem to be minor and did not want to bother property management, or tenants were hiding something from the property manager, like a pet or an unauthorized guest. Some of these unreported issues, especially water leaks, beeping smoke detectors, and pests, could potentially negatively impact the health of tenants if there was a longer time until they were resolved due to a decrease in physical inspection frequency.

Though funding agencies did not typically inspect all units of a property—and therefore did not find all existing housing maintenance issues affecting tenants—some property managers used physical inspections as an impetus to encourage tenants to report housing maintenance issues. Among other instructions to tenants about preparing for inspections, such as housekeeping, property managers asked tenants to report housing maintenance issues so they could be repaired before the funding agency's inspection. With fewer inspections, these tenants would likely be asked to report housing maintenance issues less often, which could increase the length of time until housing condition problems were resolved. Property managers shared practices that assisted tenants in reporting housing maintenance issues, with the goal of reducing underreporting. Many of the property managers spoke from experience and discussed actions they took to encourage tenants to report housing problems, with most of these actions involving educating tenants and providing proactive and approachable property management. A property manager with HUD, OHFA, and RD funding shared how approachable property management practices benefited tenants: "I would say the most important thing is having an open door policy with your tenants so that they know that they're welcome in your office, and a lot of times that helps to assure that they are going to let you know that there is a problem in their unit." Another property manager with HUD and OHFA funding described how proactive property management assisted with identifying maintenance issues: "Well, we annually send out through our on-site managers, we do our own inspections ...physical inspections and we send out forms requesting them to report to us ...problems they may incur [sic]. That's how we stay on top of it."

“I would say the most important thing is having an open door policy with your tenants so that they know that they’re welcome in your office, and a lot of times that helps to assure that they are going to let you know that there is a problem in their unit.”

Again, these findings suggested that the alignment’s effect on housing maintenance issues depends on property management practices. Tenants who lived at properties where the staff were approachable and more proactive in resolving maintenance issues might see fewer health impacts of alignment than tenants living at other properties.

#### *The Educational Aspect of Physical Inspections*

While asking tenants to report housing maintenance issues before inspections allowed for such issues to be identified and corrected,

property managers also found that the physical inspections themselves fostered better tenant behavior and improved unit quality. Both property managers and tenants described how funding agency inspections taught tenants how to maintain their unit with housekeeping and reporting of maintenance issues. Many property managers instructed tenants to perform general housekeeping duties before funding agency inspections, and tenants described completing activities like vacuuming, washing dishes, and dusting before inspections. A property manager with HUD, OHFA, and RD funding noted that inspections provided an opportunity to educate tenants about how to best maintain their unit with housekeeping: “I find that more often you inspect the better tenant you create because eventually they are going to get to a point where they don’t want to clean, you know do these marathon cleaning things like the day before. You know, it’s all education. I mean I will say to them, ‘You know if you want to make life easier on yourself, just keep your unit clean on a regular basis and you don’t have to do all this every time I walk through.’” Another property manager with HUD, OHFA, and RD funding agreed that inspections provided opportunities for tenant education: “Occasionally when the inspection discloses something that should have been reported and we point that out to the resident, again that’s almost an advantage because I think otherwise I think it would continue to be unreported.” This educational aspect of inspections—that they teach tenants how to maintain healthy living conditions—was a paternalistic view mentioned in tenant interviews.

Many tenants indicated that they completed preparation activities as instructed by their property manager, but some had added to their preparation activities in response to their experiences with previous inspections. In addition to general housekeeping, many tenants described more in-depth preparations, including changing the furnace filter, replacing smoke detector batteries, making sure electrical outlets are secure, and checking for plumbing leaks or other deficiencies. A tenant shared how her preparation activities were similar to inspections: “I did check... because I know they check like the outlets, the sinks, the bathrooms, the usual... running water and all that stuff.” The property manager and

tenant interviews revealed that preparing for inspections was health protective—whether tenants performed general housekeeping, report maintenance issues, or made more intensive preparations. It is possible that reducing the frequency of inspections could affect tenant health if it results in tenants not maintaining their units as regularly. Whether reduced inspection frequency would impact the learning experience of inspections was not clear.

#### *Time of Year and Physical Inspections*

A property manager with OHFA and RD funding mentioned that the current frequency of physical inspections meant that housing issues were not missed due to the time of year: “No, I haven’t noticed anything. Again when you have two, three or four [inspections] a year you’re usually throughout the seasons.” Property managers were asked if they had noticed that issues were missed during a physical inspection due to the time of year that the inspection occurred. Half of the property managers noted that the season or weather did not result in the inspector missing any housing condition issues. Some property managers mentioned housing problems that were more apparent during certain seasons, such as air leaks that were more noticeable during cold weather, doors or windows that swelled shut due to humidity, and water leaks that only manifested during rain or snow. Any of these issues could potentially impact the health of tenants if they were unresolved, and reduced inspection frequency could mean that these issues would not found and repaired.

#### *Variability Among Inspectors*

A recurring theme that emerged from property manager interviews was variability among individual inspectors from the same agency. Property managers stated that not all inspections by a funding agency were of the same quality or as likely to identify housing condition problems. A property manager with HUD and OHFA funding described this theme: “Funding source monitors can tend to vary depending on how... how, how do I say this? How dedicated the person is that’s coming here. Uh, we’ve had some that have just walked through and in two minutes they are done; they’re gone.” Another property manager with HUD funding agreed: “It depends on who is inspecting and what their purpose is and what their motivations are. Some inspectors... can walk through a 50 or 60 unit project in an hour or two and some inspectors will take all day long. It’s an individual characteristic of the inspectors.” Property managers described how some inspectors failed to show up to the property for the inspection, and other inspectors were viewed as being stricter than the inspection protocol. When speaking about how a reduction in frequency would affect property quality, a property manager with HUD and OHFA funding summarized how inspector variability complicates the impact that the alignment would have on properties: “Some inspectors do little; some do what they are supposed to do. In some sense... you know if everyone’s thinking of cutting back some inspections, in some case it wouldn’t affect anything because they aren’t really doing anything.” The effect that reducing the frequency of physical inspections would have on identifying housing condition problems to some extent depends on the consistency of inspectors within and across agencies.

### **III. Conclusion**

1. The property manager and tenant interviews revealed evidence that physical inspections identified housing condition problems that would not be addressed by property managers in the absence of an inspection; however, the realignment would likely affect properties differently.
2. Property managers varied in how they maintain their properties, with those who follow a preventive maintenance schedule being more likely to identify housing condition problems without an inspection than property managers who relied on pre-inspecting their property.
3. Physical inspections were identified by many property managers and tenants as a catalyst for tenants to report housing maintenance issues, so if inspections were reduced, proactive and approachable property management would become more important for encouraging tenants to report problems without an upcoming inspection.
4. In addition to identifying housing condition problems, property managers and tenants noted that physical inspections educate tenants about how to maintain their unit and that housing maintenance issues should be reported, though the effect that decreasing inspection frequency would have on tenant education was not clear from the key informant interviews.
5. Some property managers mentioned that certain housing condition problems were more apparent during specific seasons, indicating that issues like air leaks and stuck doors could be missed if physical inspections did not occur during the necessary season.
6. Finally, many property managers emphasized that inspector reliability within and across agencies was not consistent. Efforts to increase consistency among inspectors could minimize the impact that a reduced frequency of physical inspections would have on the identification of housing condition problems.

## *Question 5: How disruptive are physical inspections for tenants?*

### **I. Introduction**

The physical inspection protocol requires inspectors to enter individual housing units multiple times per year to meet compliance requirements for each funding agency. Tenants living in affordable housing must give access to their home for these inspections in addition to other inspections required by owners and managers. Aligning the inspection process to reduce the frequency may offer an opportunity to reduce the impact on the resident while continuing to meet compliance regulations. A literature review is not provided for this section due to a gap in the literature about this topic.

### **II. Primary Data Collection Results**

Physical inspections by funding agencies were only one type of inspection affecting tenants of subsidized properties. As a property manager with HUD and OHFA funding described, tenants' units can be inspected by multiple sources yearly: "If you look at a property that has double or triple subsidies... You know these tenants could have inspections eight out of twelve months including preventative and pest control, regular and annual inspections from the site staff, corporate inspections, mortgage inspections, and each one of the entities that regulate depending on what type of subsidy you get, so they hate it." Tenant interviews revealed that, in reality, inspections have varying effects on tenants, depending how on tenants prepared for inspections and maintained their unit, their physical abilities, and their general attitude toward inspections.

#### *Preparing for Physical Inspections*

Tenants performed a range of activities to prepare for physical inspections. Most tenants recalled cleaning their apartment before the inspection, including cleaning windows, appliances, floors, and surfaces. Other tenants described organizing clutter, changing the furnace filter, securing electrical outlets, and addressing floor trip hazards. One tenant explained that the extent of her physical inspection preparations varies according to funding agency: "It is a lot. It is a lot especially when like HUD comes out and does the inspections. That's when they give us the list, when HUD comes out to do them." While most tenants made preparations, some tenants did not prepare for inspections because they always keep their unit in good condition or they were never told to prepare for inspections. Some tenants understood that they needed to prepare for inspections, but usually did not do so due to a disability. A tenant from a rural community recalled a time that preparing for inspections was particularly difficult for him because of a disability: "...they check the vents to make sure they're clean. And I have a stepstool and everything, but I... my balance is so bad that I can't really do it. Although I did it the last time. I had never ever cleaned my vents the whole time I've been here and they were filthy. So I did get up there and I just... I don't know what I held on to, but I took a knife and got them ducts down." Another tenant described how she could not make the preparations that were necessary for inspections: "If I was to do everything that they requested it would definitely affect me with every one. You know like pulling the furniture out for the bug inspections and taking the bed clothes off

of the bed so they can get to the mattress, I can't do all that. I can get it off, but I can't put it all back together. And I can't move my furniture so if like... it would affect me greatly if I had to do all that."

Most tenants stated that they have never had to make special arrangements for the day of the inspection, as their property managers had either arranged a time that was convenient for their schedule or had permission to enter the apartment without the tenant being home. Some tenants made minor arrangements, such as ensuring that pets were restrained in cages. A few tenants did share special arrangements that they made

**"I think I like inspections. I think they're a good way to gauge how you know, money is spent with programs like this because you know, you don't want to be wasting money on a place that's not standard enough for people to live in."**

(or foresee themselves having to make in the future) for the day of the inspection, which largely involved making sure an adult was present for the inspection if they had to be elsewhere. One tenant described how she is uncomfortable being alone with an inspector in her house, so she tries to make sure another adult is present with her during the inspection. The same tenant also said she has had to reschedule medical appointments that would have taken place during the inspection because she felt that being absent would be a detriment: "Yes, I have had to reschedule appointments because they... if they make an appointment it's kind of hard to reschedule and it counts against you. Because they'll tell you that you failed the first inspection because you cancelled that inspection."

### *Tenants' Perceptions of Inspections*

The tenant interviews revealed a wide range of opinions regarding physical inspections. Tenants described neutral feelings, unease, or appreciation for physical inspections; some tenants held a combination of these feelings. A majority of tenants made a statement suggesting they did not have strong feelings about inspections at least once during their interview. A tenant stated that she was comfortable with having inspectors in her home: "I live the way I live, and either they like it or they don't.... I'm not changing anything just because I've got somebody coming in for inspection." Similarly, another tenant shared that inspections do not disturb her: "So they could come... to be honest, if they want to come every month I don't care." Interestingly, that same tenant made contradicting statements later in her interview, indicating that inspections made her feel uneasy: "You never know who is going to get pulled until that morning which... I get nervous like you know we get the notice, 'Somebody will be... you know in 24 hours.' I get a little nervous and I hurry up..." Later, she added, "I'm a nervous wreck and I want to make sure everything... maybe not perfect, but everything... I hurry up and go around." Other tenants described feeling nervous or afraid before and during inspections. One tenant described how inspections

**"The difference between HUD and the landlord is if our landlord comes out, we will get in trouble. If HUD comes out he'll get in trouble."**

made her feel uneasy: "My neighbors... they were like, 'Yeah, HUD is out here for an inspection,' so I had to run in the house and you know, clean everything that was on that list. It was very crazy." She continued, "Um... they're very scary. Because you really don't know when they are going to come out or it could be the littlest thing they are looking at and say, 'You

failed...'" Toward the end of her interview, this tenant demonstrated that she felt some appreciation for physical inspections because it placed the burden of property maintenance on the property manager: "The difference between HUD and the landlord is if our landlord comes out, we will get in trouble. If HUD comes out, he'll get in trouble." Other tenants also showed appreciation for physical inspections, saying they were responsible for keeping units up to a standard, provided a sense of security, ensured that funds were being spent wisely, and served as an opportunity to clean up. A tenant described how inspections made her feel more confident in the quality of her apartment: "It's nice to know that someone's looking out after you like that, you know. It means a lot. You don't have to worry about moving in and the ceiling falling in or the ceiling leaking... If they think it's good enough then you know it's going to be good. I feel that way." Another agreed that inspections hold properties to higher standards: "I think I like inspections. I think they're a good way to gauge how you know, money is spent with programs like this because, you know, you don't want to be wasting money on a place that's not standard enough for people to live in."

### **III. Conclusion**

1. Physical inspections have differing effects on tenants according to how they maintained their unit and prepared for inspections, their physical abilities, and their attitude toward inspections.
2. Most tenants made efforts to prepare for physical inspections, and a few tenants had to make special arrangements for the day of the inspection.
3. Tenants with disabilities had the greatest difficulty preparing for physical inspections, indicating that inspections might be more disruptive for them.
4. Though most tenants indicated that inspections do not disturb them at some point during their interview, many also felt uneasy about the inspection process. Some tenants shared feelings of appreciation for inspections, saying that inspections were responsible for keeping properties in good condition and ensured that funds were not being wasted.



# RECOMMENDATIONS

Based on the literature review and primary data analysis and stakeholder engagement, the following have been created to summarize the key findings from this HIA project. The recommendations have been created to minimize the negative health impacts that may result of a reduction of frequency of physical inspections.

Currently, every funding agency conducts physical inspections, but the information captured through the inspection process varies based on the interests and focus of the individual funding agency. The breadth and depth of the information gathered through the inspection process varies as a result. A minimal standard of information needed to promote housing-related health has not been defined, and may result in gaps for health-related maintenance issues.

Aligning the physical inspection process such that it will reduce the frequency of inspections could result in negative health consequences. The HIA research team assumed that stopping the alignment was not a feasible option, therefore the recommendations are based on the assumption the alignment would continue. The reduced number of inspections will increase the time between regular physical inspections conducted by federal and state agencies, thus relying on owners and managers to regularly inspect and maintain housing units. Changes in the mandated inspection schedule may unintentionally modify maintenance activities and inspections conducted by an owner or property manager, as the current inspection frequency generally serves as an incentive for maintenance of affordable housing properties. It is important to recognize that decreased maintenance of housing units will also reduce housing quality and generate negative health consequences. Yet, given that tenants expressed that physical inspections can be a burden as well, it is important to acknowledge that improved efficiencies created by the alignment may also reduce the stresses and other disruptions created by physical inspections.

Affordable housing serves low-income households. All tenants living in affordable housing were considered vulnerable for this HIA; however, particular attention should be focused on older adults (aged 55 and older), children and adults with disabilities, and children (birth to age 17). These tenants are more susceptible to negative health impacts due to poor housing quality.

A “one size fits all” inspection schedule is likely to ignore existing conditions that would put tenants at higher risk for negative health consequences. Additional considerations should be made to ensure properties that are more likely to have health-related housing quality issues receive the inspections needed to adequately identify housing issues.

## *Recommendations*

- 1. Develop and implement a standardized physical inspection tool to increase consistency in reports and non-compliance remediation to optimize health.**

Physical inspections are not created equal. While the inspection tools are based on the same UPCS, findings of non-compliance differed between agencies. These differences could fail to consistently detect housing quality issues, resulting in missed opportunities

to maintain healthy affordable housing. Policy makers should adopt one, standardized physical inspection tool across participating agencies to increase reporting consistency, non-compliance reporting, and to optimize health of tenants. The physical inspection alignment presents an opportunity to improve the consistency of physical inspections. Using a uniform format to detect housing quality issues would assist with any summary report of non-compliance between agencies. Decision makers should consider existing housing quality inspection tools that optimize tenant health and housing quality standards. An inspection standard should be adopted that will appropriately identify issues of non-compliance, but also includes elements to protect the health of vulnerable tenants. Our results demonstrate the need to adopt techniques to improve the quality of information.

A standardized, health protective inspection tool should include all housing quality issues, prioritize those that impose a more detrimental impact, and produce a summary measure to prioritize at-risk projects (see Recommendation #3). A health protective physical inspection tool should meet the following minimal standards: 1) inclusion of elements that capture housing-related health issues, 2) an increased depth of information about the elements, and 3) consider attributes that may be missing from existing inspection tools.

New inspection tools do not need to be developed to increase the health-protectiveness of the physical inspection alignment. Existing inspection tools could be used. For example, the existing inspection tool used by the Real Estate Assessment Center (REAC), within HUD, is a comprehensive tool and scoring system to assess the physical quality of affordable housing. Analyses should also be conducted to determine the reliability and validity of the UPCS or REAC system. Additionally, the Healthy Home Rating System (HHRS) might be a promising inspection system; however, further consideration and analyses would have to be conducted to assess how the UPCS and the HHRS could be integrated into one inspection tool.

With any new inspection protocol implementation, training of inspection staff on any new protocol will be essential. If policy makers adopt a single inspection standard, they need to consider the training needs of inspection staff carefully prior to implementation. Training will be critical during the alignment implementation to ensure housing inspectors identify and document all housing quality issues. The reliability and accuracy of reporting should be monitored by funding agencies on an on-going basis.

**2. Establish ongoing training to increase the quality of physical inspection reports and to raise awareness of housing-related health issues among inspectors.**

Ongoing quality control of physical inspection reports, to prevent attrition or drift from the existing protocol, is needed independent of any new inspection protocol alignment. This report recommends additional training to enhance the quality of physical inspection reports. Given that physical inspection reports varied considerably within and across agencies, additional training would assist in streamlining execution of physical inspections, and subsequently, the data gathered. Additionally, consistent training should enhance the inspector's ability to reliability gather data in the real world environments encountered in the field. Housing inspectors also need to be oriented to specific housing-related issues that impact the health of tenants. A review of existing healthy housing training may be beneficial.

**3. Develop and implement a risk-based inspection agenda that focuses resources, streamlines inspection schedules based on housing and tenant characteristics, and is protective of adverse exposures and health.**

It is important to treat the inspection schedule differently based on the potential health-related housing quality issues identified in this HIA. Factors that need to be considered in the inspection agenda are the characteristics of the properties themselves and the tenants that occupy those properties.

With regard to housing characteristics, two were independently identified as having a greater number of health-related housing quality issues: property age and property size. As a result, policy makers should consider modifying the inspection schedule based on these property characteristics, potentially including both in any risk-based assessments used to determine monitoring frequency. The frequency of an inspection should vary depending on the age of a property, the number of units, and inspection history. Properties that were recently built and have less than 30 units had fewer housing quality issues; however, for certain “high risk” properties, the number of housing quality issues skyrocketed. A formal analysis could be conducted of existing properties based on units, age of the structure, and violations to assist in building a predictive algorithm to identify “high risk” properties.

With regard to tenant characteristics, affordable housing tenants may all be considered to be vulnerable populations, based on the income qualifications required to be included within this group. Yet, subgroups within may be at an increased health risk. In particular, older adults, families, and individuals with disabilities may be differentially impacted by housing quality issues. As detailed in previous sections of the report, each of these groups has unique concerns regarding housing quality. Regular maintenance of housing is essential for these vulnerable groups to achieve optimal health and safety. Housing agencies should review the potential disproportionate impact of reduced inspections on vulnerable populations, such as older adults, families with small children, and those with functional impairments. Policy makers should consider modifying the aligned inspection schedule to include population, among other factors, to more effectively meet the needs of vulnerable populations.

In order to determine which projects warrant additional inspections, agencies could utilize existing tenant-level reporting tools to monitor the presence of vulnerable populations as the make-up tenants shift over time (e.g. TRACS Tenant Characteristics Report; HFA tenant and income data, etc.). As a database of shared inspections increases (assuming a standard inspection tool and reporting format) property level information, along with additional considerations could be used to help determine the frequency of additional physical inspections to ensure the quality of affordable housing property.

Policy makers should require evidence of corrective action in response to all physical inspection reports with findings. Consistent timeframes for correcting deficiencies will ensure the health-related housing quality issues are addressed to decrease the negative health impacts on vulnerable tenants.

## MONITORING

The purpose of this health impact assessment is, through research and recommendations, to have a meaningful impact on decisions under review and on health and health determinants. The intent is to conduct work that has immediate application to decisions and activities in current practice. HIA includes a step—monitoring—to track: 1) the impact of the HIA on the decision in question, 2) the implementation of the decision, and 3) any determinants of health that may change as a result of decision implementation.

Monitoring goes hand in hand with dissemination of findings. HIA partners, OHFA and OSU, have the primary roles in monitoring. We propose the following plan to monitor the policy decision, the implementation of that decision, and the impacts on the determinants of health:

1. Monitoring the impact of this HIA on the policy decision: OHFA will be responsible for monitoring the alignment of physical inspections to determine if the HIA's recommendations have been adopted. We anticipate the impact of a final policy decision may take several years to complete, since actual implementation of the proposed policy is still under consideration, and pilot alignment projects in a limited number of states are ongoing.
2. Monitoring decision implementation: OSU College of Public Health will conduct a process evaluation to monitor the decision implementation of the physical inspection alignment in Ohio. Specifically, process evaluation data will be collected annually from representatives from the state and federal level funding agencies (HUD, RD, OHFA) regarding the satisfaction with implementation process, barriers to policy adoption, and additional resources needed to complete the implementation. We will also review the adequacy of stakeholder engagement, the development of new partnerships/coalitions/efforts, and institutional changes to address housing and health issues.
3. Monitoring the health outcomes: Assuming that funding is available to support ongoing monitoring, OSU and OHFA should gather data, at least every two years, regarding health indicators, such as respiratory health, chronic diseases, poisoning, injuries, and self-rated quality of life from a sample of affordable housing tenants. It is recommended that HUD fund the monitoring of this policy to properly understand the impacts of the alignment.

# CONCLUSION

This HIA examined the health impacts of a proposed policy modification to reduce the frequency of physical inspections of affordable housing properties. The potential effects of these housing-related health issues and the potential impact on the prevalence of respiratory disease, injury, and mental health were explored. The proposed physical inspection alignment reduces agency duplication and the frequency of disruptions to tenants. The program efficiencies and reduced agency duplication are important in light of reduced state and federal funding; however, the proposed alignment could potentially increase the length of time until poor housing conditions are repaired or decrease the scope of inspections, leading to poor housing conditions. Living in poorly maintained housing contributes to asthma and other respiratory symptoms, neurological problems, injury, and mental health problems.

The results of this HIA show that physical inspections do identify health-related housing quality issues, however, the inspection protocols provided inconsistent information across agencies based on the interests and focus of the individual funding agency. The diversity of affordable housing properties, in terms of the size and age of properties, were also found to have a vastly different prevalence of housing quality issues, which may lead to negative health consequences. The proposed changes in the mandated inspection schedule may unintentionally modify maintenance and inspections conducted by an owner or property manager, as the current inspection frequency serves as an incentive for maintenance of affordable housing properties. It is important to recognize that decreased maintenance of housing units will also reduce housing quality and generate negative health consequences.

The policy recommendations in this report present viable options moving forward with the physical inspection alignment, while ensuring the health and safety of affordable housing tenants in Ohio and nationally. It became evident that a one-size-fits all inspection protocol is likely to ignore existing conditions that would put tenants at higher risk for negative health consequences. A minimal standard of information is needed to promote housing-related health. Through standardization, training, and identifying tenants and properties most at risk, the physical inspection alignment policy could be successful.

The Interagency Rental Policy Working Group has continued to implement the pilot of the physical inspection alignment. As of this publication, the states participating in the pilot continue to develop appropriate memorandums of understanding between agencies and test potential implementation strategies. The physical inspection alignment has not been implemented nationally, but there are discussions about expanding the pilot project to additional states.

# SECTION SIX

## PROJECT PRINCIPALS

### **Project Principals:**

*Ohio Housing Finance Agency*

*The Ohio State University, College of Public Health*

### **Stakeholder Advisory Group:**

*White House Domestic Policy Council, Federal Rental Policy Working Group*

*Ohio Housing Finance Agency*

*U.S. Department of Housing and Urban Development*

*USDA Rural Development*

*Coalition on Homelessness and Housing in Ohio*

*Ohio Department of Aging*

*Ohio Department of Mental Health and Addiction Services*

*Ohio Department of Health*

# SCOPING PATHWAYS

We identified two scoping pathways to guide this HIA: the first focused on the efficiency of reduced inspection frequency, and the second focused on housing quality issues. The efficiency pathway focused on the business case to reduce the frequency of physical inspections, while the housing quality pathway addressed the specific housing quality issues associated with the identified health determinants. The resulting pathways included some common elements, but are hypothesized to impact health through different mechanisms and resulted in health impacts that differ in important ways. Health, as it relates to housing, is impacted primarily through inspection frequency related to tenants, property managers, and the mix of resources for funding agencies.

The first scoping pathway addressed the efficiency of physical inspections, and focused on how the reduced frequency of inspections had potential to impact the vulnerable populations in affordable housing. This pathway illustrated the hypothesized mechanisms that result in health impacts, namely the disruptions of physical inspections on both tenants and property managers, the time spent by property managers on other property issues, and the change in resources allocated for affordable housing properties.

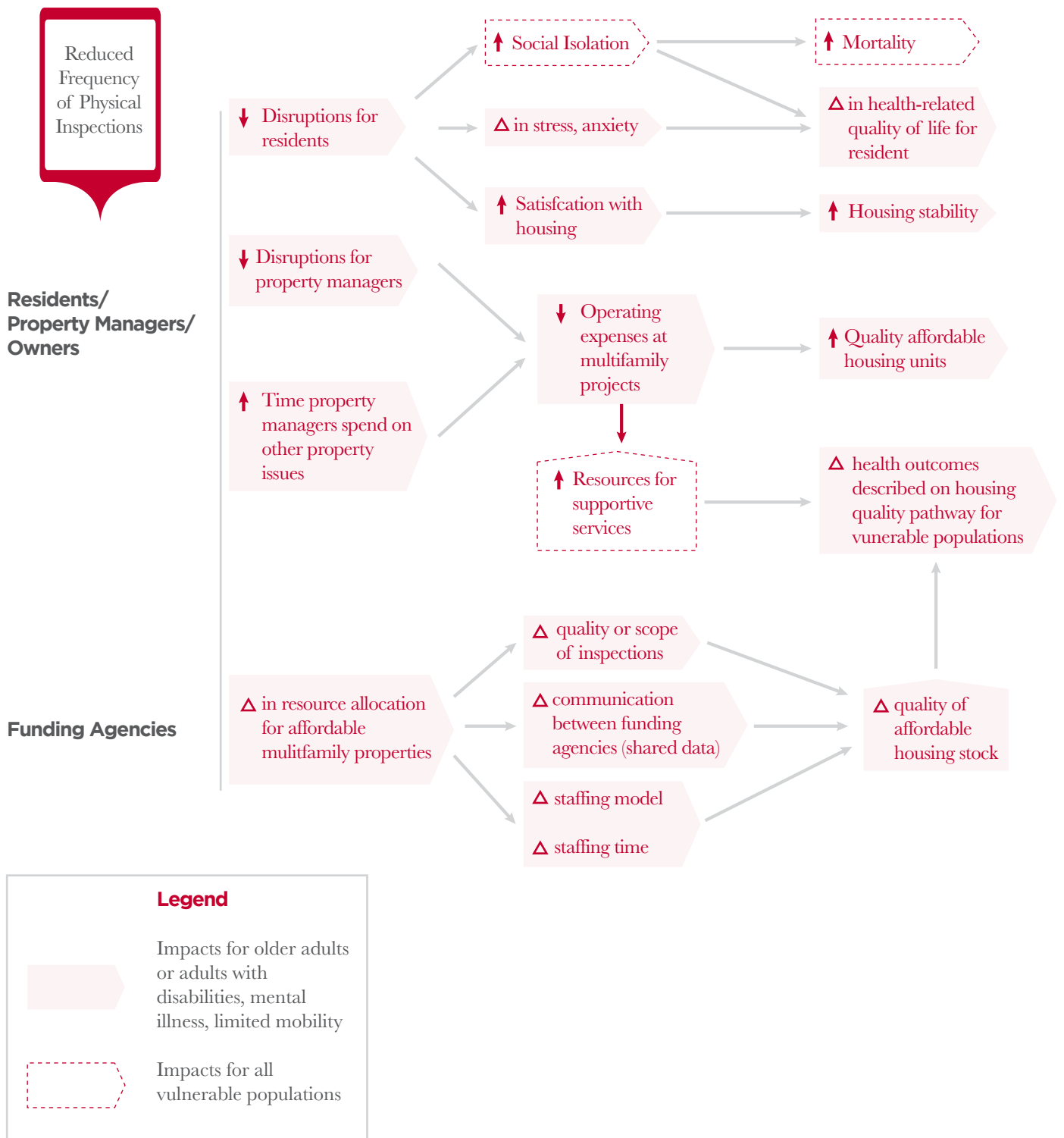
Important factors are revealed through these three identified groups (tenants, property managers, and funders) that influence the identified health risks or determinants. For tenants, these influential factors include social isolation, stress, and housing satisfaction. For property managers, the factors include operational expenses, which link to resources for supportive services. For funders, these determinants are quality of inspections, communication between funders, and staffing issues.

The health-related outcomes that were hypothesized to result through these factors include impacts on mortality and health related quality of life (for tenants). Property managers can expect impacts to include increased housing stability and quality. Funders, and indirectly, property managers, can expect impacts in health outcomes that result from the relevant changes to housing quality that impact tenants.

The second pathway focused on the housing quality issues that specifically impact tenants. The hypothesized changes function through two main routes: change to the length of time for housing issue resolution and change to the scope of inspections. Both are assumed to impact overall housing quality.

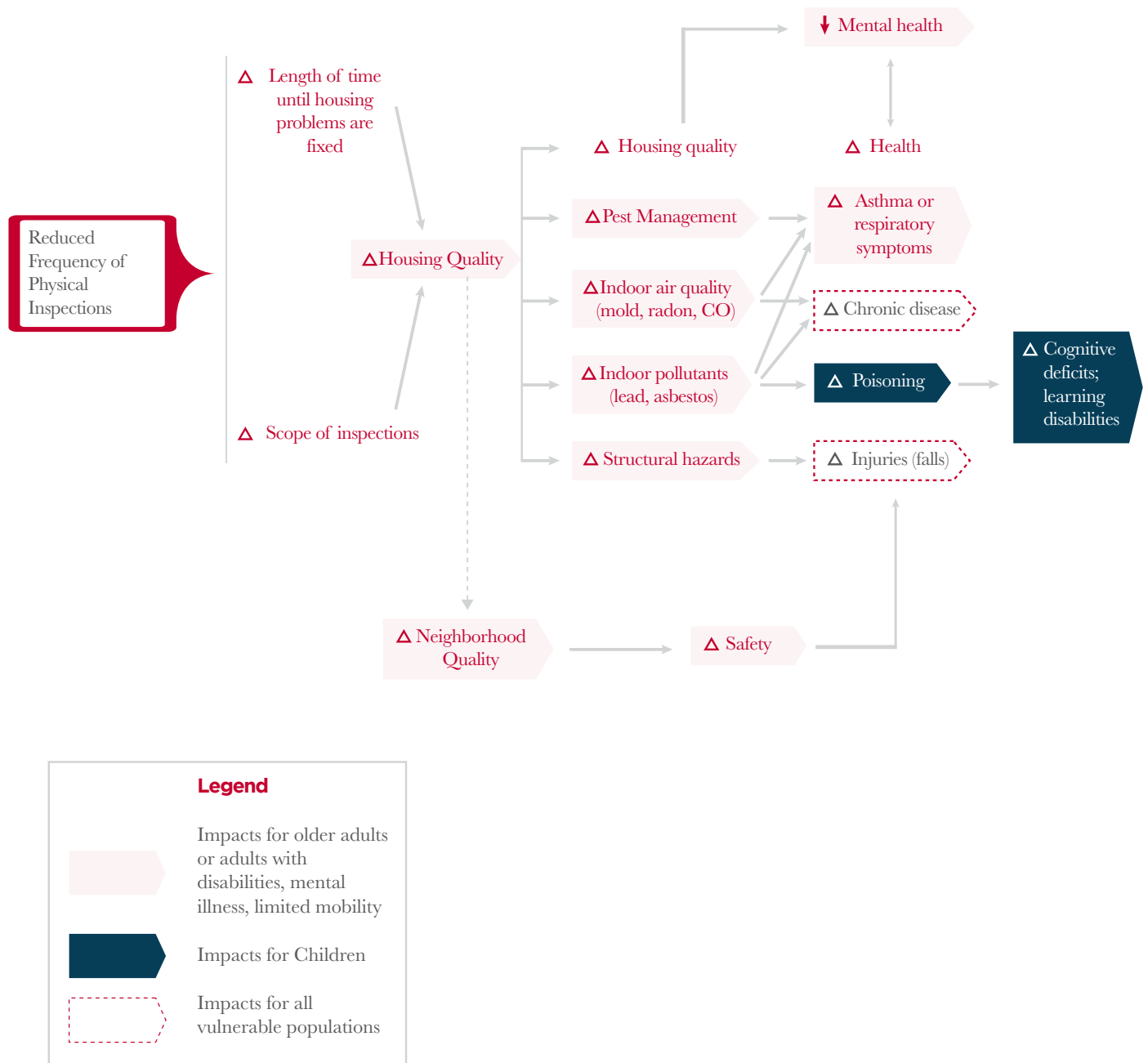
The resulting changes to housing quality were hypothesized by the research team to influence health in several identified areas, including pests, air quality, pollutants, and structural hazards. Each of these health determinants has at least one resulting health impact; several of these determinants are associated with more than one area of health impact. For tenants, the resulting health impacts include asthma or respiratory symptoms, chronic disease, poisoning, and injuries.

# 1. Scoping Pathways for Efficiency of Inspections for Vulnerable Populations





## 2. Scoping Pathways for Housing Quality for Vulnerable Populations



# HOUSING QUALITY ASSESSMENT TOOLS

## *Healthy Housing Index (HHI)*

The Healthy Housing Index (HHI) is an observational tool administered by trained building inspectors that was developed based on the British HHSRS, , and other standards (Keall, Baker, Howden-Chapman, & Cunningham, 2008; Keall et al., 2012). The validity of the 29-item injury hazard subscale was assessed by analyzing the association between the total number of hazards in the home and injuries that occurred and required medical intervention within two years, in a relatively small pilot study (n=102 households) (Keall et al., 2008). Results showed that each additional injury hazard was associated with 22% increase of injury. The study's strength was that the injury hazards focused on were structural issues, rather than characteristics more likely to be confounded with underlying health or behavioral issues also related to injuries (e.g., shower grab bars).

More recently, the validity of a 12-item respiratory hazard index in the HHI was reported using data collected from 891 households that applied for a subsidy to receive insulation and lived in homes built before 1980 (Keall et al., 2012). As an example, the index included items ranging from “feels a little damp” to “major leaks in roof.” Participants self-reported the occurrence of several respiratory symptoms in the past 12 months, including wheezing or whistling in the chest and asthma attacks. After controlling for smoking status, age, gender, and crowding, a one point increase in the respiratory hazard index was associated with 11% higher odds (statistically significant) of having whistling/wheezing or with having an asthma attack. There was some evidence that this relationship was stronger in the youngest age group (0-6 years).

Nriagu et al. (2011) developed a housing assessment tool based on the instruments reviewed by Jacobs (2006) and described previously. Unfortunately, this tool was administered by telephone and therefore included only self-reported, as opposed to visual, inspection data. The tool included 71 specific hazards in the same categories described above, plus pets and lifestyle factors. The researchers derived scores (range 0-5) for each hazard based on the likelihood that housing occupants would be exposed to the hazard, and the potential for serious health impacts from the hazard, with higher scores indicating more frequent or serious problems. Thus, visible mold had a score of five, while holes or cracks in the ceilings received a two. The tool, and an accompanying list of health problems (i.e., disease burden), were administered to a random sample of 642 households in Saginaw, Michigan. The hazard inventory showed acceptable internal consistency, and correlations between hazard scores and summed disease burden scores were significant for all categories except pest, fire, and pet hazards. While it would not be appropriate to use a self-reported assessment tool for physical inspections addressed in the current HIA, the severity scores calculated for hazards in this tool may be applicable to hazards identified in visual inspections as well.

## *Housing Health and Safety Rating System (HHSRS)*

The recently developed British Housing Health and Safety Rating System (HHSRS) meets all of these criteria, with the possible exception of cost. The HHSRS was introduced in the Housing Act 2004 to provide a mechanism for local housing authorities to identify and address housing problems (Burrige & Ormandy, 2007). It includes 29 housing conditions,

based on research about the relationship between each condition and potential health and/or safety problems. The HHSRS explicitly focuses on hazards that can be “attributed solely or partly to the design, construction and/or maintenance of the dwelling,” as opposed to occupant behaviors and does not limit the assessment of potential harms to current occupants. For example, a hazard specific to young children would be noted and rated as such even if there were no young children currently living in the dwelling. During the assessment, trained inspectors rate hazards based on the likelihood that a potential hazard would cause harm within the next twelve months, and the range of possible harm outcomes that could result. Based on assessment results, local housing authorities can notify landlords and tenants of identified problems or request/require landlords to fix problems.

### ***Healthy Home Rating System (HHRS)***

In the U.S., HUD recently released the Healthy Home Rating System (HHRS), which is based directly on England’s HHSRS (U.S. Department of Housing and Urban Development, 2012). HUD has written extensive operating guidance for the HHRS, including hard copy and electronic scoring sheets. Additionally, two-day training on HHRS is currently available through the National Healthy Homes Training Center and Network. The HHRS is the assessment methodology encouraged by HUD to evaluate risks to occupant health posed by housing-related hazards. for the Lead-Based Paint Hazard Control Grant Program and Lead Hazard Reduction Demonstration Grant Programs.

The Healthy Housing Inspection Manual, published by the CDC and HUD in 2008 (Centers for Disease Control and Prevention (CDC), 2008), is another comprehensive resource for health-related housing problems. This manual includes extremely detailed lists of items to assess during visual inspections that may impact health. For most items, multiple levels of adequacy (or lack thereof) are described. The manual also includes detailed cross-references to the International Property Maintenance Code (IPMC). The stated purpose of this manual is to be a “model reference tool”; it does not introduce new housing standards or modifying existing inspection requirements or regulatory authority. No information was found about the reliability or validity of this assessment tool in the research literature or governmental reports.

# PROPERTY MANAGER INTERVIEW GUIDE

Hello [name],

I'm \_\_\_\_\_, a research assistant at The Ohio State University's College of Public Health. We are conducting interviews to understand the value and impact of physical inspections conducted by the Ohio Housing Finance Agency, HUD, and Rural Development. We are interested in interviewing you because of your experience as a property manager in an affordable multifamily rental property. The interview will last about 30 minutes and will take place over the phone. If you choose to participate, we will schedule an interview time that is convenient for you. Would you be interested in participating?

- a. If yes, ask if there are any questions about the process and schedule the interview.
- b. If no, thank them for their time and end contact.

## *Consent script:*

Good morning/afternoon. I'm \_\_\_\_\_ from The Ohio State University's College of Public Health. Thank you for agreeing to be interviewed today. The purpose of this interview is to understand the value and impact of physical inspections conducted by the Ohio Housing Finance Agency, HUD, and Rural Development. Today's interview will last about 30 minutes. Your participation in this interview is voluntary, and you may end the interview at any time. We will record the interview, and your responses will be kept private and confidential. Individual manager names, property location, and address will not be identified in the results.

1. Do you have any questions regarding the process?  
[Read italicized text for consent form, below]

*The purpose of this research is to examine the health impacts of a proposed policy modification to reduce how often physical inspections are done at housing properties in Ohio. These housing issues include pests, indoor air quality, water leaks and mold, structural hazards, peeling paint, and neighborhood safety, and their potential impact on the lung health, injuries and mental health.*

*As a participant in this interview, you will be asked questions about the practices and experiences you have as a property manager or property owner. The interview will last about 30 minutes, and you will not be contacted after your completion of the interview.*

*As a participant of this study, you will not receive any direct benefit of participation; however, the information you provide may be beneficial to the health and wellbeing of tenants throughout Ohio. We do not believe there are any risks of taking part of this study. We will only ask questions about professional practices related to property maintenance and inspections. You do not have to answer any question that makes you feel uncomfortable.*

*Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. Information provided may be reviewed by the following groups (as applicable to the research):*

- *Office for Human Research Protections or other federal, state, or international regulatory agencies;*

- *The Ohio State University Institutional Review Board or Office of Responsible Research Practices;*
- *The Robert Wood Johnson Foundation or Pew Charitable Trust who are supporting the study.*

*For questions, concerns, or complaints about the study you may contact Dr. Elizabeth Klein at 614-292-5424.*

*For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.*

*If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.*

2. Do you provide consent to begin this interview?
  - a. If yes, the interviewer will commence interview.
  - b. If no, thank the participant for their time and end the interview.

### *Interview script*

*I am going to begin with some general questions about the property you manage.*

3. How often was your property inspected in the past three years by OHFA, HUD, or RD (depends on the type of property)?
4. Were there other entities that monitored the property you manage (i.e. PBCA [project based contract administrator], local government, or asset manager)?
  - a. How often did they inspect the property?
  - b. Was the inspection(s) similar to those conducted by the state or federal agency? If not, what do they look for?
5. Are your maintenance staff company employees or contractors?
6. How many maintenance staff is onsite? (#/unit)
7. Would you describe what kinds of maintenance issues may go unreported by tenants? (Probe—Why do you think this is?)
8. Would you describe the factors that might prevent or assist tenants reporting housing maintenance issues?

*Now that you've told us a little about the property you manage and general maintenance reported by your tenants, I'd like to ask you some questions about physical inspection process and how it impacts your job.*

9. Would you describe how you prepare for a physical inspection?
  - a. How long does this take (For example, the number of hours for the property manager, for the maintenance staff, etc.)? (Probe—What preparations are typical?)
  - b. How far in advance do you start preparing for physical inspections?
10. Do you prepare differently for different agencies' inspections? [If yes, ask to describe how the preparation is different.]
11. How far in advance do you notify tenants that a physical inspection is scheduled?
  - a. Do you provide specific instructions to tenants before the inspection?
12. On the day of the inspection, how long does the physical inspection take?
  - a. How does this impact your daily operations?
13. Would your preparation activities change with fewer or more physical inspections?
14. How would a change in the frequency of physical inspections affect the way you do your job?
15. What do you think you would do differently if you had fewer physical inspections? (Probe—problem resolution)
16. How does the physical inspection affect your tenants?
  - a. How would a change in the frequency of physical inspections affect your tenants?
17. Have you found that something was missed during a physical inspection due to the time of day or time of year that the inspection occurred? (Probe—issues with rain/snow/ice, lighting at night)
18. Is there anything else you'd like to tell me about physical inspections?

# TENANT INTERVIEW GUIDE

Hello [name],

I'm \_\_\_\_\_ from The Ohio State University's College of Public Health. We are interviewing people to understand the value and impact of physical inspections conducted by state and federal agencies such as HUD. Your name was given to us by [person] at [agency], who thought that you would be a good person for us to interview since you live in federally assisted rental housing. The interview will take about 30 minutes and will take place in person. We can schedule the interview for a time that fits with your schedule, and you will receive a \$10 Walmart gift card to thank you for your time. Would you be interested in being interviewed?

- a. If yes, ask if participant has ever been notified that his or her apartment might be inspected. If participant has been notified of a potential inspection, schedule the interview. If not, thank them for their time and end contact.
- b. If tenant does not wish to participate, thank them for their time and end contact.

## *Introductory interview script:*

Good morning/afternoon. I'm \_\_\_\_\_ from The Ohio State University's College of Public Health. Thank you for agreeing to be interviewed today. The purpose of this interview is to understand the value and impact of physical inspections carried out by the Ohio Housing Finance Agency, HUD, and Rural Development. Today's interview will last about 30 minutes. Your participation in this interview is voluntary, and you may end the interview at any time. We will record the interview, and your responses will be kept confidential and private. Individual manager names, property location, or address will not be identified in the results. You will receive a \$10 Walmart gift card to thank you for your time.

1. Do you have any questions before we begin?  
[Provide the consent form to the participant]
2. Do you provide consent to begin this interview?
  - a. If yes, the interviewer will commence interview.
  - b. If no, thank the participant for their time and end the interview.
3. How long have you lived at your current address?
4. What was the condition of your apartment when you moved in? (Probe—What aspects specifically were good and bad?)
5. Describe the process of submitting a maintenance request. (Probes—How do you tell someone that you need something fixed? (in writing or verbally) Are your requested filled? How long does it take for the request to be fulfilled? What are some of the common issues that you request to be fixed? Is a copy of the work order left for you after the job was completed?)

APPENDIX FIVE

*Now that you've told me some things about your apartment, I'd like to ask you a few questions about apartment inspections.*

6. In the past year, how often were you notified that your apartment might be inspected? (Specify number of times)
7. Have you ever had your apartment inspected? (Probe—Would you tell me about the experience?)
8. What [did] [would] you think about having your apartment inspected?
9. How much notice are you given before an inspection?
10. What [did] [would] you do to prepare for an inspection?
  - a. Have you been told to do anything to prepare for the inspection?
  - b. Did the manager inspect your apartment before HUD (or other state agencies) came?
  - c. How long does this take? (Specify number of hours)
11. [Did] [Would] you make special arrangements for the day of the inspection occurs? (Probes—take off work, arrange for childcare, board pet)
  - a. If they take off work, ask how many hours.
  - b. If arrange for childcare, ask if this is an extra expense.
  - c. If reschedule medical appointments.
12. Has anything been found during an inspection?
13. When things are found during the inspection, how are they addressed by management?
  - a. How long does it take to fix those items?
  - b. Who/what was deemed responsible for the issue(s)?
14. Have you found that something was missed during a physical inspection due to the time of day or time of year that the inspection occurred? (Probe—issues with rain/snow/ice, lighting at night)
15. How would a change in the number of physical inspections affect you or members of your family? (Probe—how it would affect the apartment)
16. Is there anything I didn't ask about that I should know about housing inspections?



# INSPECTION CODING

Violation Category	Description
<p style="text-align: center;"><b>Fire</b></p>	<ol style="list-style-type: none"> <li>1. Smoke detector: inoperable, damaged, loose, missing, needs batteries, and not wired to other smoke detectors</li> <li>2. Paint over ceiling sprinklers</li> <li>3. Blocked egress: furniture, debris, and stuck or inoperable windows and doors</li> <li>4. Stove fire hazards</li> <li>5. Hot water tank: inaccessible due to debris piles and missing or damaged pressure relief valve</li> <li>6. Incorrect or faulty wiring: malfunctioning breaker, outlets hanging by wires</li> <li>7. Improper storage of flammable materials: charcoal lighters, gasoline, gasoline-powered machinery, and cardboard boxes; furniture or debris improperly stored on or near heating unit</li> <li>8. Expired fire extinguisher</li> <li>9. Smoke damage and cigarette burns</li> <li>10. Housekeeping issues identified by inspector as a fire hazard</li> </ol>
<p style="text-align: center;"><b>Pests</b></p>	<ol style="list-style-type: none"> <li>1. Window screens: damaged, missing, bent, and does not fit window</li> <li>2. Windows: broken, not sealed</li> <li>3. Doors: do not close, threshold not sealed</li> <li>4. Screen doors: damaged or missing screens and missing storm door</li> <li>5. Roaches, bugs, gnats, bed bugs, ants, rodents, spiders and spider webs, water bugs, millipedes, wasps, bird nest, animal scratches</li> <li>6. Inspector identified unsanitary conditions as a predictor for infestation</li> </ol>
<p style="text-align: center;"><b>Mold</b></p>	<ol style="list-style-type: none"> <li>1. Mold and mildew</li> <li>2. Water stains, water damage, water leaks, standing water, and moisture</li> <li>3. Bathroom exhaust fan: inoperable, malfunctioning, unsecured, disconnected, and noisy</li> </ol>

# APPENDIX SIX

Violation Category	Description
<p style="text-align: center;"><b>Appliances</b></p>	<ol style="list-style-type: none"> <li>1. Refrigerator: damage, leaks, not level, needs replaced, missing, runs constantly, and too warm</li> <li>2. Freezer: leaks, frost, and does not close</li> <li>3. Garbage disposal: inoperable, clogged, no splash guard, needs reset, and noisy</li> <li>4. Dishwasher inoperable</li> <li>5. Range and oven: excessive grease in hood, missing knobs, damage, malfunctioning burners, light needs replaced, light covers missing, not level, faulty temperature, range hood not sealed, range hood not secure, broiler needs replaced, old, sharp edges, no drip pan, no range, rust, inoperable igniter, no gas, and burns</li> <li>6. Hot water tank: broken and rusted</li> <li>7. Dirty and greasy appliances</li> <li>8. Laundry machines: damaged, vents missing, and hose vents inside or is detached</li> <li>9. Air conditioner: draining problems, rattling, and old, inefficient, missing</li> <li>10. Timer needs replaced</li> </ol>
<p style="text-align: center;"><b>Air Quality</b></p>	<ol style="list-style-type: none"> <li>1. Ventilation: broken vent covers, inoperable vents, damaged vents, inoperable exhaust system, and dirty and loose HVAC returns</li> <li>2. Range hood: inoperable fan, noisy, damaged, missing, slow fan, no filter, no screen, and dirty</li> <li>3. Odors: unspecified, sewer, cat urine, and gas</li> <li>4. Furnace filter: missing filter and change filter</li> <li>5. Boarded up windows</li> <li>6. Air conditioning: not reliable, replace filter</li> </ol>
<p style="text-align: center;"><b>GFCI (Ground Fault Circuit Interrupter)</b></p>	<ol style="list-style-type: none"> <li>1. Does not trip or reset/failed test</li> <li>2. Inoperable</li> <li>3. Missing</li> <li>4. Slow to trip</li> <li>5. Damaged: cracked plate, needs secured, and loose socket</li> </ol>

Violation Category	Description
<p style="text-align: center;"><b>Handicap Accessibility</b></p>	<ol style="list-style-type: none"> <li>1. Inaccessible kitchen findings: work surface, cabinets, refrigerator and freezer, range controls, shelves, too small, no accessible hardware, faucet, and stove</li> <li>2. Inaccessible bathroom findings: grab bar, shower head, no seat in tub, sink, clearance space, door lock, shower controls, toilet, and mirror</li> <li>3. Maneuverability findings: no ramp, steep ramp, and not enough clearance space/ rooms too narrow</li> <li>4. Inaccessible patio</li> <li>5. Unit not accessible, unspecified</li> <li>6. Other accessibility findings: thermostat, door peep sight, door handle, electric box, and trash receptacle</li> <li>7. Emergency call: inoperable, string too high, no system, missing string, and no light or failed light</li> <li>8. No accessible routes from handicap units to mailbox, laundry room, and office</li> </ol>
<p style="text-align: center;"><b>Plumbing</b></p>	<ol style="list-style-type: none"> <li>1. Sink: damaged, leaking, cracked, clogged, does not hold water, and not secured</li> <li>2. Toilet: loose, damaged, leaking, running, handle sticks, does not flush properly, inoperable, needs replaced, slow to drain, leaking flapper valve, backs up, missing cap, standing water, and noisy</li> <li>3. Shower/tub: leaking shower head, leaking pipes, unspecified leaks, broken shower head, dripping, clogged, and replace faucet</li> <li>4. General plumbing: clogged drains, running water, leaking pipes and faucets, seal pipe penetration through wall, un-insulated pipes, repair pipe insulation, leaking drain, difficult or inoperable faucet knob, missing drain cover, corrosion, leaking pump, damaged cleanout cover, valve leak, loose faucet, water pressure issues, dripping bi-line, replace access panel, and leaking water line coupler</li> <li>5. Hot water tank: extend drain and drop pipe, fix piping, missing drop pipe, seal pipe and electrical penetrations through wall, odor, "squeals," loose pipes, leaks, missing blow-off pipe, missing cover plate, and missing clamp</li> </ol>
<p style="text-align: center;"><b>Trip Hazard</b></p>	<ol style="list-style-type: none"> <li>1. Cords across floor</li> <li>2. Splintering stairs</li> <li>3. Patio cracks and gaps</li> <li>4. Structural pad gaps</li> <li>5. Carpet: holes, peeling, loose, torn, and unspecified carpet tripping hazards</li> <li>6. Thresholds: damaged, coming up, loose, and sharp</li> <li>7. Flooring damage: holes/cavities, peeling, loose floor boards, cuts, loose tiles</li> <li>8. Unspecified tripping hazards</li> </ol>

## LITERATURE REVIEW SUMMARY

### *Efficiency of Inspections (Scoping pathway #1)*

Authors (Year)	Title	Health Outcome	Study Design
Burr et al. (2007)	Effects on patients with asthma of eradicating visible indoor mold: A randomized controlled trial	Asthma/ respiratory	Randomized controlled trial
Kercsmar et al. (2006)	Reduction in asthma morbidity in children as a result of home remediation aimed at moisture sources	Asthma/ respiratory	Randomized controlled trial
Peters, Levy, Rogers, Burge, & Spengler (2007)	Determinants of allergen concentrations in apartments of asthmatic children living in public housing	Asthma/ respiratory	Cross-sectional
Rauh, Chew, & Garfinkel (2002)	Deteriorated housing contributes to high cockroach allergen levels in inner-city households	Asthma/ respiratory	Cross-sectional
Phipatanakul et al. (2004)	Effect of environmental intervention on mouse allergen levels in homes of inner-city Boston children with asthma	Asthma/ respiratory	Randomized controlled trial
Howden-Chapman et al. (2008)	Effects of improved home heating on asthma in community dwelling children: Randomised controlled trial	Asthma/ respiratory	Randomized controlled trial

Sample	Summary of Findings
Asthma patients aged 3-61 years (n=95 intervention; n=87 control)	This study examined whether removing mold would affect asthma symptoms. Houses were randomized into intervention (mold removal, fungicide application, and fan installation) and control groups (delayed intervention). Six months after implementation, the intervention group was more likely see improvement in wheezing that limited activity and to perceive medication reduction and improved breathing. After 12 months, the intervention group had greater improvement in rhinitis and rhinoconjunctivitis and had greater reductions in the use of preventive medication and relievers.
Asthmatic children aged 2-17 years (n=29 intervention; n=33 control)	Authors examined how remediating indoor moisture sources affected childhood asthma morbidity. Homes in the intervention group had water damaged materials removed, water infiltration reduced, heating/ventilation/air conditioning altered, and other environmental cleaning to reduce mold exposures. After remediation, the intervention group had a significant decrease in symptom days, which was not also found in the control group. From 6 months to 12 months post-remediation, participants in the intervention group were less likely to have visited the emergency department or inpatient services for asthma-related symptoms than control group participants.
N=49 apartment units occupied by at least one asthmatic child aged 4-17	This study sought to determine the relationship between certain housing conditions (e.g., holes in ceilings/walls and housekeeping) and pest allergen levels. Below-average housekeeping was the only housing condition significantly associated with high concentrations of airborne cockroach allergens. Additionally, below-average housekeeping was a predictor of high cockroach allergen concentrations in beds. In kitchens, below-average housekeeping, holes in the ceiling/walls, and units that had not been renovated were significantly associated with higher concentrations of cockroach allergen.
N=132 Dominican and African American women aged 18-35 years	The authors observed whether allergen distribution was a function of housing deterioration. Housing deterioration was quantified by the presence and frequency of specific housing condition problems (e.g., holes in walls/ceiling, leaking pipes, or water damage). Housing deterioration was positively associated with kitchen allergen levels, and bedroom allergen levels were positively associated with housing instability.
N=12 intervention and N=6 control homes of children with positive mouse allergen skin tests and asthma, as well as evidence of mouse infestation or exposure	This study was conducted to determine the effectiveness of an environmental intervention to reduce mouse allergen levels. Homes in the intervention group received integrated pest management. The integrated pest management homes had significantly decreased levels of mouse allergen after five months compared to control homes.
Children ages 6-12 with physician-diagnosed asthma were randomized to intervention (n=200) and control (n=209)	Researchers tested whether more effective home heating resulted in improved respiratory health in asthmatic children. The intervention group received a more effective, non-polluting heater before winter. The intervention did not improve lung function in the intervention group compared to the control group. According to parent-reported health outcomes, children in the intervention group were less likely to have poor or fair health, sleep disturbed by wheeze, or nocturnal dry coughing compared to the control group.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Thomson, Thomas, Sellstrom, & Petticrew (2009)	The health impacts of housing improvement: A systematic review of intervention studies from 1887 to 2007	Asthma/ respiratory; mental health	Systematic review
DiGuseppi, Roberts, & Li (1998)	Smoke alarm ownership and house fire death rates in children	Injury	Ecologic
Marshall et al. (1998)	Fatal residential fires: Who dies and who survives?	Injury	Case-control
Ahrens (2010)	Home Structure Fires	Injury	Ecologic
Runyan, Bangdiwala, Linzer, Sacks, & Butts (1992)	Risk factors for fatal residential fires	Injury	Case-control
Lin (2004)	Life risk analysis in residential building fires	Injury	Case-control
Diguseppi, Jacobs, & Phelan (2010)	Housing interventions and control of injury-related structural deficiencies: A review of the evidence	Injury	Systematic review

Sample	Summary of Findings
Review of 45 interventions	Authors reviewed the literature to determine the health impacts of housing improvements. There were four areas of focus, with the warmth/energy efficiency area being relevant. The 19 warmth/energy interventions that were identified included improvements to at least one of the following: insulation, central heating system, and flued heat source. Most of these studies occurred in low-income areas. Improvements to general health, respiratory health, and mental health were observed. The authors concluded that warmth improvements could lead to improved health, but that the impact likely depends on baseline housing conditions.
Death certificate records for all children who died at ages 0-14 between 1980 and 1995 in England and Wales	The authors used surveillance data to observe the relationship between trends in smoke alarm ownership and child deaths resulting from residential fires. A significant relationship was found between smoke alarm ownership and decreased rates of residential fire deaths in children aged 0-4 years.
N=190 people who died in a residential fire (cases); n=64 people who did not die in a residential fire in North Carolina (controls)	Researchers were interested in identifying the factors that differentiated fatal fire outcomes (cases) from nonfatal fire outcomes (controls). Individuals were classified as high-vulnerability (younger than 5 years, older than 64 years, physically or cognitively disabled, or impaired by alcohol and drugs) or low-vulnerability to represent their individual risk of dying in a residential fire. The presence of a smoke detector reduced death rates from residential fires for both the high-vulnerability and low-vulnerability groups.
Data for this report came from the United States Fire Administration's National Fire Incident Reporting System, 2003-7	The report discussed the causes of residential fires in the United States as well as prevention measures that have proven successful. Compared to one- and two-family homes, there were lower rates of fires caused by heating equipment and electrical distribution in apartments, which the author suggested was due in part to better oversight by apartment property managers and regulatory authorities. Smoke alarms emerged as particularly important for preventing fire deaths. Though 96% of homes have at least one smoke alarm, 63% of home fire deaths occurred in the absence of a working smoke alarm. Interconnected smoke alarms were identified as more protective than standalone smoke detectors.
N=151 fatal fires (cases); n=283 nonfatal fires (controls)	The authors were interested in establishing risk factors for fatal residential fires fatal in rural areas. Heating equipment was the leading source of both fatal and nonfatal fires. The presence of smoke detectors decreased risk of fire fatality. In stratified analysis, smoke detectors were found to be relatively more protective in situations when no one in the residence was impaired, when children were present, and when no one in the residence was disabled.
N=59 fires causing fatality or injury; n=360 non-fatal/non-injury fires	This study explored behavioral and building characteristics to determine what factors lead to a fire that caused injury or death compared to fires that caused no injuries or deaths. The degree of difficulty for escaping the fire (e.g., blocked egress, few exits, or stairways being too narrow) was significantly associated with fire injury or fatality.
Review of 17 interventions	The purpose of this review was to identify housing interventions that result in positive impacts on health outcomes, especially injuries and poisoning. Only structural deficiencies that would be the responsibility of a property owner or manager to remediate were included in the review. Of the 17 interventions that were reviewed, 3 were deemed to have sufficient evidence supporting implementation. Of those, one would be addressed by housing interventions: installation of working smoke detectors. Interventions identified for further evaluation included: home modification to prevent falls (e.g., installation of handrails or grab bars), safe ignition sources and controls, home modification to provide egress for fire escape, and functional air-conditioning during heat waves.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Campbell et al. (2005)	Randomized controlled trial of prevention of falls in people aged $\geq 75$ with severe visual impairment: The VIP trial	Injury	Randomized controlled trial
Cumming et al. (1999)	Home visits by an occupational therapist for assessment and modification of environmental hazards: A randomized trial of falls prevention	Injury	Randomized controlled trial
Pardessus et al. (2002)	Benefits of home visits for falls and autonomy in the elderly	Injury	Randomized controlled trial
G. W. Evans, Wells, Chan, & Saltzman (2000)	Housing quality and mental health	Mental health	Cross-sectional, quasi-experimental
Wells & Harris (2007)	Housing quality, psychological distress, and the mediating role of social withdrawal: A longitudinal study of low-income women	Mental health	Quasi-experimental



Sample	Summary of Findings
<p>Adults 75 years or older (n=100 in safety assessment/home modification group; n=97 in exercise group; n=98 in both groups; n=96 in control group)</p>	<p>This study tested interventions to reduce fall frequency in elderly, visually impaired adults. Participants were randomized to one of four groups: home safety assessment and modification, exercise, both, or neither. Compared to the control group, the home modification group had significantly fewer falls. Additionally, when comparing groups that received the home modification (home modification only group and both interventions group) to groups that did not, the groups receiving home modification had significantly fewer falls than the exercise only and control groups.</p>
<p>Elderly adults (age 65 years and older) recently discharged from a hospital were randomized to intervention (n=264) or control (n=266)</p>	<p>Researchers were interested in determining if addressing environmental hazards reduced the risk of falls. The intervention group received a home environmental assessment and any necessary modifications. At follow up (approximately a year), the intervention group had significantly fewer falls than the control group. The intervention was found to be significantly more effective among participants who had a history of falls compared to those who had no history of falls.</p>
<p>Adults age 65 years or older who were hospitalized for a fall and able to return home after hospitalization were randomized to intervention (n=30) or control (n=30)</p>	<p>The purpose of this study was to determine if reducing fall risks in the home would improve the autonomy of elderly adults and prevent falls. The intervention group received a home risk assessment and modification when appropriate, and the control group received no treatment. No difference was observed between the intervention and control group in fall rates post-intervention. The intervention group had significantly less loss of autonomy at 6- and 12-months follow-up.</p>
<p>Two samples: n=207 mostly white, low- and middle-income mothers in a rural community; n=31 urban mothers who moved into a Habitat for Humanity home during the study</p>	<p>Researchers examined associations between housing quality and non-clinical psychological distress. Among the rural sample, better housing quality was significantly associated with less psychological distress after controlling for poverty level. Among the urban sample, change in housing quality was significantly associated with an improvement in post-move psychological distress after controlling for pre-move distress.</p>
<p>N=48 low-income women who were moving into newly constructed homes</p>	<p>This study examined how improving housing quality affects mental health. The researchers followed the participants from before they moved to a newly constructed home to after their move. Analysis revealed that changing housing quality predicts post-move psychological distress and that social withdrawal mediates the relationship between mental health and housing quality.</p>

## *Housing Quality (Scoping Pathway #2)*

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Antova et al. (2008)	Exposure to indoor mould and children's respiratory health in the PATY study	Meta-analysis	Randomized controlled trial
Belanger et al. (2003)	Symptoms of wheeze and persistent cough in the first year of life: Associations with indoor allergens, air contaminants, and maternal history of asthma	Asthma/ respiratory	Prospective cohort
Chen, Tsai, & Lee (2011)	Early-life indoor environmental exposures increase the risk of childhood asthma	Asthma/ respiratory	Case-control
Dharmage et al. (2001)	Current indoor allergen levels of fungi and cats, but not house dust mites, influence allergy and asthma in adults with high dust mite exposure	Asthma/ respiratory	Cross-sectional
Gruchalla et al. (2005)	Inner City Asthma Study: Relationships among sensitivity, allergen exposure, and asthma morbidity	Asthma/ respiratory	Prospective cohort
Gunnbjörnsdóttir et al. (2006)	Prevalence and incidence of respiratory symptoms in relation to indoor dampness: The RHINE study	Asthma/ respiratory	Cross-sectional, prospective cohort

Sample	Summary of Findings
N=57,099 children aged 6-12 years	The authors pooled data from 12 original cross-sectional studies to determine air quality's effects on childhood respiratory disorders. Significant associations were found between mold exposure and eight respiratory symptoms, including wheeze, asthma, bronchitis, nocturnal dry cough, morning cough, sensitivity to inhaled allergens, hay fever, and being woken by wheeze.
N=849 infants with an asthmatic sibling	The authors measured numerous home exposures, including indoor allergens, fungi, and nitrogen dioxide, and prospectively measured the frequency of infant wheeze and persistent cough. Among infants of mothers with no asthma history, exposure to gas and wood-burning stoves significantly increased the risk of persistent cough. Presence of mold/mildew was significantly associated with infant persistent cough and wheeze regardless of mothers' asthma status.
N=579 mothers of 12- to 14-year-old children participating in the Taiwan Children Health Study	This study explored the relationship between childhood asthma and exposure to indoor environmental risk factors. The researchers found that early-onset and ever-having asthma had statistically significant associations with early life exposure to cockroaches and visible mold. Mildew odors were associated with early-onset, late-onset, and ever-having asthma.
N=485 adults	The authors assessed indoor levels of fungi and dust mite allergens' influences on asthma in adults. High exposure to total airborne fungi and fungal biomass were associated with asthma.
N=234 inner city children aged 5-11 years with moderate to severe asthma	The relevant part of this study examined allergen sensitivities and exposures and their association with asthma morbidity. Children who had cockroach allergen sensitivity and allergy were found to have more asthma symptom days, more caretaker interrupted sleep, and more missed school days than children who were not sensitive or exposed to cockroach allergens.
N=16,190 adults ages 20-44 at baseline	This study's purpose was to analyze the relationship between indoor dampness and respiratory symptoms using baseline and follow-up surveys measuring indoor dampness and respiratory health. Significant associations were found between measures of indoor dampness (e.g., water damage and visible mold) and all measured respiratory symptoms (wheezing, nocturnal shortness of breath, nocturnal coughing, expectorating phlegm or having difficulty expectorating phlegm). Longitudinal analysis revealed that incident respiratory symptoms were significantly more common among participants living in damp houses.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Han, Lee, & Guo (2009)	Indoor environmental risk factors and seasonal variation of childhood asthma	Asthma/ respiratory	Cross-sectional
Iossifova et al. (2009)	Mold exposure during infancy as a predictor of potential asthma development	Asthma/ respiratory	Prospective cohort
Jaakkola, Hwang, & Jaakkola (2004)	Home dampness and molds, parental atopy, and asthma in childhood: A six-year population-based cohort study	Asthma/ respiratory	Prospective cohort
Karvonen et al. (2009)	Confirmed moisture damage at home, respiratory symptoms and atopy in early life: a birth-cohort study	Asthma/ respiratory	Prospective cohort
Lee, Lin, Hsiue, Hwang, & Guo (2003)	Indoor and outdoor environmental exposures, parental atopy, and physician-diagnosed asthma in Taiwanese schoolchildren	Asthma/ respiratory	Cross-sectional
Lee, Hsiue, Lee, Su, & Guo (2006)	Home exposures, parental atopy, and occurrence of asthma symptoms in adulthood in southern Taiwan	Asthma/ respiratory	Cross-sectional
Litonjua, Carey, Burge, Weiss, & Gold (2001)	Exposure to cockroach allergen in the home is associated with incident doctor-diagnosed asthma and recurrent wheezing	Asthma/ respiratory	Prospective cohort

Sample	Summary of Findings
N=1725 children with asthma symptoms	The authors sought to examine indoor environmental factors' relationship to seasonal childhood asthma. Cockroach presence was associated with summer/fall asthma; visible mold was associated with winter and spring asthma; and water damage increased risk of asthma year-round.
N=483 infants enrolled at baseline	This study reported how exposure to visible mold during infancy affects early childhood asthma risk. Children who had high presence of visible mold in their homes at infancy were significantly more likely to have respiratory symptoms at age three that put them at risk for asthma development.
N=1,916 children aged 1-7 years without asthma at baseline	The authors were interested in longitudinally assessing the effect of mold exposure on childhood development of asthma. Exposure to mold in the home (e.g., water damage, moisture and visible mold, and mold odor) was measured at baseline, and asthma development was documented in the six-year follow-up survey. The presence of mold odor was found to be an independent determinant of incident asthma.
N=396 children were followed from birth to 18-months	This study's purpose was to determine observed moisture damage's impact on childhood respiratory morbidity and atopic sensitization. Kitchen moisture damage and visible mold in the main living area (especially the child's bedroom) were associated with physician-diagnosed wheezing.
N=35,036 children aged 6-15 years	The researchers identified risk factors for physician-diagnosed asthma using cross-sectional surveys. For girls, cockroaches, visible mold, and water damage were associated with asthma; visible mold was the only risk factor associated with asthma in boys.
N=24,784 adults aged 26-50 years with a child attending elementary of middle school	The authors were interested in assessing the relationship between adult asthma and home environmental factors. Visible mold was independently associated with adulthood asthma symptoms. The presence of cockroaches was also positively associated with asthma, but the relationship was not statistically significant. A statistically significant association was found when mutually adjusted models were applied between home exposure (e.g., cockroaches, visible mold, dogs, or avoidance of environmental tobacco smoke or pets) and new-onset asthma.
N=222 young children	The authors assessed the relationship between incident asthma and exposure in children to indoor allergens, including dust mites and cockroaches. Exposure to cockroach allergen at baseline was a significant predictor of incident physician-diagnosed asthma and recurrent asthmatic wheezing.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Matheson et al. (2005)	Changes in indoor allergen and fungal levels predict changes in asthma activity among young adults	Asthma/ respiratory	Prospective cohort
Matsui et al. (2006)	Household mouse allergen exposure and asthma morbidity in inner-city preschool children	Asthma/ respiratory	Prospective cohort
Perry, Matsui, Merriman, Duong, Eggleston (2003)	The prevalence of rat allergen in inner-city homes and its relationship to sensitization and asthma morbidity	Asthma/ respiratory	Cross-sectional
Wang, Abou El-Nour, & Bennett (2008)	Survey of pest infestation, asthma, and allergy in low-income housing	Asthma/ respiratory	Cross-sectional
Phipatanakul, Celedón, Sredl, Weiss, & Gold (2005)	Mouse exposure and wheeze in the first year of life	Asthma/ respiratory	Prospective cohort
Jacobs, Wilson, Dixon, Smith, & Evens (2009)	The relationship of housing and population health: A 30-year retrospective analysis	Asthma/ respiratory	Ecologic
Evans, Hyndman, Stewart-Brown, Smith, & Petersen (2000)	An epidemiological study of the relative importance of damp housing in relation to adult health	Asthma/ respiratory, chronic disease	Cross-sectional

Sample	Summary of Findings
N=360 adults	The authors measured the relationship between changes in allergen and fungal exposure and changes in asthma and other respiratory symptoms over time. Analysis by two-year follow-up found that a doubling of fungal exposure resulted in greater odds of having had an asthma attack and atopy development. Increased odds of bronchial hyperactivity development were associated with doubling of dust mite allergen.
N=127 inner-city children aged 2-6 with physician-diagnosed asthma	This study examined whether exposure to mouse allergen was a risk factor for asthma morbidity in inner-city children. Blood samples were collected and skin testing was conducted at baseline to establish whether children were sensitized to mouse allergen. Dust samples were obtained and health care usage and symptom questionnaires were administered at baseline, then at 3 months and 6 months. Sensitized children who were also exposed to high levels of mouse allergen had more asthma symptom days, more days of beta-agonist usage, and were more likely to have an unscheduled physician visit, have an emergency department visit, or be hospitalized than other children who were less sensitized to mouse allergen and/or had lower levels of exposure.
N=489 asthmatic children from inner-city areas	Authors examined the relationship between exposure to rat allergen, sensitization, and asthma in inner-city children. Children who were both sensitized and exposed to rat allergen had a significantly greater number of unscheduled medical visits, slowed activity days due to asthma, and hospitalizations.
N=1,173 residents from 358 randomly selected public housing units	Researchers used interviews and evaluated interior environmental conditions to determine relationships among cockroaches, mice, cockroach allergen level, asthma, and allergy rate. Existence of asthma was positively correlated with mouse infestations.
N=498 children with at least 1 parent with a history of asthma or allergy in metropolitan Boston	This study explored the relationship between mouse exposure in infancy and wheeze development during the first year of life. Infants who were exposed to mice at home had significantly higher odds of developing wheeze than infants with no exposure to mice. Additionally, exposure to cockroach allergen was significantly associated with wheeze development.
Data from two nationally representative, longitudinal surveys from approximately 1970-2000	Authors analyzed data from the National Health and Nutrition Examination Survey and the American Housing Survey to observe how potentially related housing and health trends change together over time. A relationship was found between trends in the prevalence of asthma and certain housing conditions: increases in forced air furnaces, central air conditioning, and broken windows/bars on windows (theoretically reflecting increased stress).
N=8,889 adults aged 18-64	The population-based survey was used to evaluate associations between self-reported damp housing and health outcomes, controlling for potentially confounding housing and health covariates. Difficulty keeping housing warm in the winter rather than damp housing was associated with asthma, longstanding illness, healthcare utilization, and all dimensions of the SF-36 (a measure of overall health status).

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Bräuner et al. (2008)	Indoor particles affect vascular function in the aged: An air filtration-based intervention study	Chronic disease	Randomized, double-blind, crossover study
Dedman, Gunnell, Davey Smith, & Frankel (2001)	Childhood housing conditions and later mortality in the Boyd Orr cohort	Chronic disease	Prospective cohort
Diez Roux et al. (2001)	Neighborhood of residence and incidence of coronary heart disease	Chronic disease	Prospective cohort
Duarte, Chambers, Rundle, & Must (2010)	Physical characteristics of the environment and BMI of young urban children and their mothers	Chronic disease	Cross-sectional
Lin, Lin, Lin, & Chuang (2009)	The effects of indoor particles on blood pressure and heart rate among young adults in Taipei, Taiwan	Chronic disease	Quasi-experimental
Marsh, Gordon, Heslop, & Pantazis (2000)	Housing deprivation and health: A longitudinal analysis	Chronic disease	Prospective cohort



Sample	Summary of Findings
N=21 nonsmoking elderly couples	Researchers investigated controlled exposure to indoor air particles' effects on microvascular function (MVF), as well as inflammation and oxidative stress. Filtrating re-circulated indoor air for 48-hours improved MVF, but did not have significant effects on inflammation or oxidative stress.
N=4,168 children who participated in the Boyd Orr cohort from 1937-1939 and died between 1948-1998	This study examined the influence of childhood housing conditions on mortality later in life. Results showed small effects of lack of private indoor water supply on coronary heart disease mortality and of poor ventilation on overall mortality after controlling for childhood and adult socioeconomic status.
N=13,009 participants aged 45-64 years	The researchers examined the relationship between neighborhood characteristics and coronary heart disease incidence. Risk of coronary events was higher among disadvantaged neighborhoods than advantaged neighborhoods after controlling for income, education, and occupation. When added to regression models, established coronary heart disease risk factors had only small effects on the relationship between coronary heart disease incidence and neighborhood characteristics.
N=1997 dyads of 3-year-old children and their mothers	The authors assessed the association between conditions of the physical environment and body mass index (BMI) of children and their mothers. Child BMI was related to interior decay and exterior deterioration, after controlling for socio-demographic factors. All measures of interior and exterior housing conditions were associated with maternal BMI.
N=40 young (median age was 22 years), healthy non-smokers attending universities in Taipei	This study evaluated the association between indoor air particles (PM10, PM2.5, and nitrogen dioxide) and elevated blood pressure and heart rate, as well as comparing the changes in these variables when home windows are left open or closed. Exposure to PM10 and PM2.5 was associated with elevated systolic blood pressure, diastolic blood pressure, and heart rate. These effects were greatest during periods when windows had been left open. When participants were told to keep their windows closed, there was not a significant change in blood pressure or heart rate. Authors concluded that closed windows protect against PM exposure and reduce risk of elevated blood pressure and heart rate.
Responses to five sweeps of the National Child Development Study in Great Britain: 1965: 15,425 1969: 15,337 1974: 14,647 1981: 12,537 1991: 11,407	Authors analyzed data from the National Child Development Study to understand the impact that poor housing has on health. The index of multiple housing deprivation includes quality as well as more subjective factors, such as one's satisfaction with his or her housing and residential area to operationalize poor housing. The authors found that housing (both current and past) has a significant association with poor health. Additionally, among those who do not currently live in deprived housing, poor health is more common among those who lived in housing deprivation early in life than those who did not.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Schootman et al. (2007)	The effect of adverse housing and neighborhood conditions on the development of diabetes mellitus among middle-aged African Americans	Chronic disease	Prospective cohort
Hippisley-cox, Groom, Kendrick, Coupland, & Webber (2002)	Cross sectional survey of socioeconomic variations in severity and mechanism of childhood injuries in Trent 1992-7	Injury	Cross-sectional
Hong, Lee, Ha, & Park (2010)	Parental socioeconomic status and unintentional injury deaths in early childhood: Consideration of injury mechanisms, age at death, and gender	Injury	Retrospective cohort
Istre, McCoy, Osborn, Barnard, & Bolton (2001)	Deaths and injuries from house fires	Injury	Ecologic
Keall, Ormandy, & Baker (2011)	Injuries associated with housing conditions in Europe: A burden of disease study based on 2004 injury data	Injury	Meta-analysis
Kendrick, Watson, Mulvaney, & Burton (2005)	How useful are home safety behaviours for predicting childhood injury? A cohort study	Injury	Prospective cohort

Sample	Summary of Findings
N=644 participants from the African-American Health Study	Researchers conducted baseline and 36-month follow-up interviews with participants to measure the association between certain housing conditions (interior cleanliness, physical condition of the interior, condition of furnishings, exterior condition, and a global rating) and development of diabetes. Several health behaviors, psychosocial qualities, health status, access to medical care, and socio-demographic characteristics were tested as confounders in the relationship between housing conditions and diabetes incidence. All five housing conditions were associated with increased odds of incident diabetes after adjusting for confounders.
N=21,587 hospital admission records for children aged 0-4 years; N=35,042 hospital admission records for children aged 5-14 years	Researchers examined the relationship between childhood injuries and deprivation by reviewing hospital admission records. The relationship between lower socioeconomic status and burns/scalds was statistically significant. Both total number of injuries and severity of injuries were associated with socioeconomic deprivation, with this relationship being the strongest for children aged 0-4 years.
N=2538 childhood injury deaths	This study explored the relationship between parental socioeconomic status (SES) and childhood injury deaths. Death certificate data from 1995-2004 was matched with birth certificate data from 1995-6 for each child who died. Indicators of parental SES were found to be related to childhood injury deaths. Among injuries that occurred in the home, mortality from falls was related to young parental age, and death from burns was related to paternal occupation.
N=7190 house fires in Dallas from 1991-7 were analyzed	The researchers examined house fires, their causes, and their related injuries. Census tract analysis showed that areas with low median income were at the highest risk of fire-related injury. Additionally, rates of injury were higher for: fires caused by heating equipment, fires in homes older than 1980, and houses without operable smoke detectors. Functioning smoke detector prevalence was lowest in homes in the lowest median income census tract.
Data from the WHO European Region (52 countries)	The authors reviewed studies and surveillance reports to establish the burden of deaths and disability adjusted life years (DALYs) from falling from the second level of homes without window guards and fires in homes without smoke detectors. They concluded that fitting window guards or raising second floor windows and installing smoke detectors would save the European Region 7,500 deaths and 200,000 DALYs per year.
N=1717 families with n=2357 children living in low-income areas	The purpose of this study was to demonstrate that certain home safety behaviors (e.g., having stair gates and functioning smoke detectors) predict childhood injury outcomes. Children in houses with installed and functional smoke detectors at baseline were significantly less likely to be admitted to the hospital or visit the emergency department than children in a home without a functional smoke alarm. The decreased hospitalization rates in children living in homes with stair gates were marginally significant.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Runyan, Casteel, et al. (2005)	Unintentional injuries in the home in the United States Part I: Mortality	Injury	Ecologic
Shai & Lupinacci (2003)	Fire fatalities among children: An analysis across Philadelphia's census tracts	Injury	Ecologic
Shai (2006)	Income, housing, and fire injuries: A census tract analysis	Injury	Ecologic
Shenassa, Stubbendick, & Brown (2004)	Social disparities in housing and related pediatric injury: A multilevel study	Injury	Ecologic
Keall, Baker, Howden-Chapman, & Cunningham (2008)	Association between the number of home injury hazards and home injury	Injury	Cross-sectional
Burdette, Hill, & Hale (2011)	Household disrepair and the mental health of low-income urban women	Mental health	Cross-sectional, prospective cohort
G. W. Evans, Wells, Chan, & Saltzman (2000)	Housing quality and mental health	Mental health	Cross-sectional, quasi-experimental
Hopton & Hunt (1996)	Housing conditions and mental health in a disadvantaged area in Scotland	Mental health	Cross-sectional

Sample	Summary of Findings
Data from the National Vital Statistics System from 1992-9	Researchers explored causes of fatal injuries that occur in the home. The leading causes of injury fatalities in the home were falls, poisonings, and fires/burns. Behind “unknown,” falls on or from stairs were the second leading cause of fall fatalities, followed by other slips, trips, or stumbles. The authors concluded that a focus on preventing fires and residential falls among older adults is needed.
N=246 fire deaths in children younger than 15 years old	This study explored causes for the high rates of residential fire deaths in Philadelphia children. Combining fire records with census tract data, researchers found significantly higher odds of dying in a residential fire in children living in census tracts in the highest quartile of: houses built before 1939, number of children younger than 15, low-income households, and single parent households.
N=1,563 fire injuries	The author analyzed fire injuries by census tract and fire marshal data to calculate injury rates per census tract. Multiple regression analysis found that older housing, low income, and vacant house prevalence had significant independent effects on fire injury rates.
N=11,735 hospital discharges for children with nonfatal injuries	The authors observed whether certain housing characteristics are mediators in the relationship between areas of poverty and increased rates of pediatric injury (specifically falls and burns) by analyzing census tract and hospital discharge data. Adjusting for owner occupancy and age of property (built before 1950) attenuated this relationship. Authors concluded that socioeconomic disparities in health could be addressed by remediating housing disparities.
N=240 people living in 102 houses	Researchers observed houses to determine the frequency of injury hazards and compared these counts to whether any residents of the house had recently sustained a related injury (within the past two years). Injury hazards were only included in analysis if they were structural (e.g., wiring or steep stairs), rather than due to resident behaviors (e.g., throw rugs). Results showed a 22% increase in odds of injury for each additional home injury hazard.
Low income, urban women with children. Cross-sectional analysis (n=2,313); longitudinal analysis (n=2,045)	Authors analyzed both cross-sectional and longitudinal relationships between housing disrepair and psychological distress. Housing disrepair was significantly associated with psychological distress at baseline, after controlling for public housing, overcrowding, emotional support, self-esteem, neighborhood disorder, and financial hardship. Increased disrepair was associated with increased distress over the study period.
Two samples: n=207 mostly white, low- and middle-income mothers in a rural community; n=31 urban mothers who moved into a Habitat for Humanity home during the study	Researchers examined associations between housing quality and non-clinical psychological distress. Among the rural sample, better housing quality was significantly associated with less psychological distress after controlling for poverty level. Among the urban sample, change in housing quality was significantly associated with an improvement in post-move psychological distress after controlling for pre-move distress.
N=447 adults ages 17-65 from 451 households	The authors were interested in examining the mental health impact of poor housing by comparing scores of a general health questionnaire to household composition, whether ill health was a factor in moving to the current dwelling, length of time at address, household income, employment status, chronic illness, and other housing problems. Problems with dampness were significantly associated with mental health status.

<b>Authors (Year)</b>	<b>Title</b>	<b>Health Outcome</b>	<b>Study Design</b>
Kyle & Dunn (2008)	Effects of housing circumstances on health, quality of life and healthcare use for people with severe mental illness: A review	Mental health	Systematic review
Shenassa, Daskalakis, Liebhaber, Braubach, & Brown (2007)	Dampness and mold in the home and depression: An examination of mold-related illness and perceived control of one's home as possible depression pathways	Mental health	Cross-sectional
Dunn & Hayes (2000)	Social inequality, population health, and housing: A study of two Vancouver neighborhoods	Mental health	Cross-sectional

Sample	Summary of Findings
<p>N=29 studies met inclusion criteria, including n=14 reporting on health care utilization; n=12 examining mental status; and n=9 focusing on quality of life</p>	<p>Two studies found that the “number of resident housing concerns” were associated with negative affect, defined feelings of anxiety, anger, and/or depression. Another study found that life satisfaction decreased with increasing concerns about housing “comfort and quality.” Authors concluded that relationships between housing quality and life satisfaction and mental health status were “weak but promising.”</p>
<p>N=5,882 adult participants of the Large Analysis and Review of European Housing and Health (LARES) project</p>	<p>Authors assessed potential mediators (perceptions of control and chronic respiratory health problems) for the relationship between dampness/mold and depression. Controlling for other socio-demographic factors, the significant relationship between dampness/mold and depression was made to be non-significant after adding perception of control and physical health problems; both of the latter were statistically related to depression. Authors defined this attenuation as evidence of mediation.</p>
<p>N=322 from lower socioeconomic status (SES) neighborhood; n=206 residents from higher SES neighborhood</p>	<p>This study assessed relationships between SES, dimensions of housing, and health status in two neighborhoods identified as having relatively low and high mortality rates. Lack of satisfaction with or pride in one’s dwelling were associated with poorer general physical and mental health status and satisfaction with health in both neighborhoods, after controlling for numerous other SES, housing, stress, and health-related indicators.</p>

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