

Constructing Safety: A Benefit-Cost Analysis to Build Safer Communities through Rental Reform

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Disclaimer:

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Executive Summary:

Upper Darby Township faces two unique but interconnected challenges: a rapidly growing tenant population and a steadily aging housing stock. Approximately 45% of Township properties are renter-occupied; this number has grown by 33% in the last three decades. Township renters have substantially lower incomes than homeowners. The lowest-income renters are heavily cost-burdened; 96% of renters earning under \$35,000 spend more than 30% of their income on rent.

Upper Darby's median home build year is 1949, roughly 30 years older than the national median; this gap has increased by three years in the past decade. Older homes are more likely to have structural inadequacies and health hazards. Blocks with higher property ages are also more likely to have higher block-level crime rates.

These factors leave Upper Darby Township with a housing stock that has an expected rate of severe housing inadequacies 40% above the national average. Upper Darby Township should weigh interventions that reduce costs to health and public safety that Township tenants bear.

Two pathways of policy change can improve the quality of life of Township tenants: the construction of new affordable units or the rehabilitation of existing units. While both goals are meritorious, this project focuses on options to increase the quality of existing units.

This evaluation projects the impact of three policy interventions: implementing a home repair program, increasing code enforcement activity, and directing behavioral interventions to better code compliance. Each alternative is filtered through four criteria: cost, benefit-cost, equity, and administrative feasibility.

It is recommended that Upper Darby Township implement Alternative Three. This policy option leverages nudge-based behavioral interventions to improve code compliance. Alternative Three satisfies every key decision rule prioritized in this analysis. Upper Darby should also consider the future implementation of Alternative One, the home repair program for small landlords.

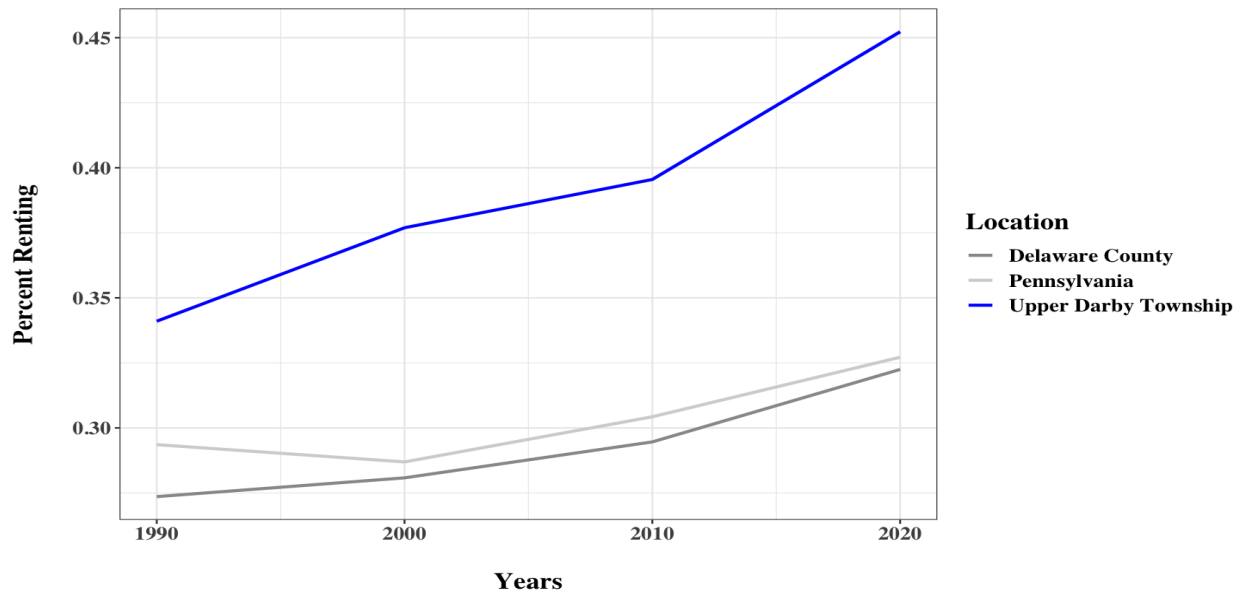
Upper Darby Township can demonstrate that rental reforms can serve as a foundation for municipalities to reduce administrative burdens, better public safety, and improve public health.

I. Introduction:

Traditional United States housing policy has focused on supporting existing homeowners and providing resources for first-time homebuyers. Until 2018, the United States spent more money on the Mortgage Interest Deduction, which benefits higher-income homeowners, than on housing vouchers and affordable housing programs combined (Schuetz, 2018). To construct housing policy that serves moderate and low-income individuals, housing policy must serve tenants.

In the last thirty years, the share of properties occupied by renters has surged in Upper Darby Township. The share of properties occupied by tenants has increased by 33% in the past thirty years. Figure One visualizes the growth in the Township's rental occupancy rate. The graph below outlines the sharp growth in Upper Darby's rental occupancy rate compared to that of Delaware County and the Commonwealth of Pennsylvania (U.S. Census Bureau, 1990-2020).

Figure 1: Percentage of Properties Occupied by Renters



Upper Darby homes are also far older than the national average. The median build year for a home in Upper Darby Township is 1949, approximately thirty years older than the national median (U.S. Census Bureau, 2022).

The gap between Upper Darby's median property age and the national median property age has increased three additional years in the last decade (U.S. Census Bureau, 2012 & 2022). Older housing stock is correlated with higher rates of property inadequacies, pulmonary health risks, and block-level crime rates (Ganesh et al., 2017; Hipp et al., 2018; U.S. Census Bureau, 2015).

Housing policy in Upper Darby Township must contend with two critical realities. The proportion of individuals renting their properties has rapidly increased at a time when the age of Township properties has steadily increased. If unmanaged, Upper Darby's housing stock will be a source of administrative burden and a risk to the health and safety of Township residents.

II. Problem Statement:

Upper Darby Township's aging housing stock is associated with **an expected rate of *severe housing inadequacies*¹ 40% above the national average** (Eggers & Moumen, 2013; U.S. Census Bureau, 2015). Upper Darby Township should weigh interventions that reduce costs to health and public safety that Township tenants bear.

¹ The American Housing Survey classifies units as severely inadequate if basic standards of heating, plumbing, and electrical wiring are unsafe.

III. Client Overview:

Home to over 85,000 residents who speak over 100 languages, Upper Darby Township is a community true to its motto: “The World in One Place” (Census, WHYY). Although literally worlds converge in the township, economically, Upper Darby residents often live worlds apart. While over one-quarter of households in the Township earn over \$100,000 a year, the lowest quarter of households earn under \$35,000 a year (U.S. Census Bureau, 2021).

Often, Upper Darby Township is compared to many of its peer municipalities in Delaware County. Such comparisons are largely unhelpful in finding solutions for Upper Darby’s policy challenges. Upper Darby is far bigger than its neighbors in East Lansdowne and far more diverse than neighboring Springfield Township. In categories ranging from population size, income inequality, and rich diversity, Upper Darby is better thought of as a small city than an large suburban community.

A better comparison for Upper Darby is likely the Township’s large western neighbor, Philadelphia. Many have nicknamed Upper Darby “West West Philadelphia” due to its continuation of neighborhoods it borders (Saffron, 2021). Table One details several key characteristics related to housing in which Upper Darby Township shows strong resemblance to Philadelphia.

Table One: Upper Darby and Philadelphia Housing Characteristics (U.S. Census Bureau, 2020; U.S. Census Bureau, 2022)

Characteristic	Upper Darby Township	Philadelphia
Median Housing Build Year (2022, ACS)	1949	1949
Median Monthly Gross Rent (2022, ACS)	\$1,202	\$1,250
Rental Occupancy Rate (2020, Census)	45.2%	51.8%
Median Population Age (2020, Census)	36.1	34.8
Mean Income (2022, ACS)	\$86,580	\$84,435

The demographic similarities between Philadelphia and Upper Darby provide an advantageous source of comparison to project policy interventions.

Upper Darby's Government:

The late political scientist Martha Derthick argued the organization of American government boils down to the question of “how many communities to be?” (Derthick, 2001). As Derthick describes, America choose to be *many* communities, with a centralized national government and many local governments (Derthick, 2001).

While states, counties, and towns are the primary sources of non-federal organization, non-national governmental organization in America takes many forms. Local planning commissions often operate by neighborhoods. Regional school boards rely on the cooperation of multiple localities. Metropolitan transit authorities require the engagement of polities that transcend state lines. American governance is rooted in this empowerment of many communities that are tasked with governing together through a loosely tied thread.

Upper Darby is a product of America's choice of many communities. The Township enjoys home rule and its own independent school district. Upper Darby also must meet federal reporting requirements, state guidelines, and coordinate with its parent county and local transit authority in almost every area of bureaucratic responsibility. Such are the costs and benefits of our choice to be many communities.

However, the question of “how many communities?” carries an even deeper meaning in Upper Darby. The Township's rich diversity requires the activation of many communities to enable effective, representative governance. Townships with growing diversity that are faced with more complex policy problems require more active, representative leadership (Zale, 2019).

Governance by many communities has passed the bulk of housing regulation to local governments. While federal and state grants fund key priorities, policy design and execution are delegated to county and municipal authorities. In Pennsylvania, public housing is managed at the county level, while the ordinances that govern zoning and tenants' rights are locally directed.

Although Upper Darby's demography resembles an urban center, the Township's bureaucratic orientation is dissimilar to larger cities like Philadelphia. While the Township is organized by a Mayor-Council system, both the Mayor and the Council are considered part-time employees and compensated accordingly. Upper Darby's Township Charter – last amended in 1988 – awards the Mayor a \$10,000 salary and Council members a \$5,000 salary. (Township of Upper Darby, Pennsylvania, 1974).

Part-time Mayors commonly hold secondary employment while in office (Rose, 2020; Upper Darby Township, n.d.). For municipalities as diverse as Upper Darby, having a part-time Mayor with a part-time City Council presents unique challenges. With Township executives paid as part-time employees, responsibilities are placed in the hands of Township's permanent staff.

The Township has wisely upscaled resources to reach the needs of its diverse constituencies. The Township website can be translated into nearly 120 different languages (Upper Darby Township, n.d.-b). The Township also has a dedicated Cultural & Community Affairs Office, launched by Upper Darby's most recent former Mayor Barbarann Keffer (Keffer, 2023). Upper Darby also celebrates an annual International Festival that provides opportunities to highlight its rich diversity.

Modern Township Administration:

Former Township Mayor Barbarann Keffer, who served between 2020 and 2024, came into office at a critical juncture for Upper Darby. As Mayor, Keffer worked to modernize key components of Township Administration from regulating sewer-usage fees to developing a one-stop constituent services center (Keffer, 2023).

Consistent with her background in environmental activism, Keffer energetically promoted initiatives to clean, green, and beautify the Township (Penn Future, n.d.; Saffron, 2021). During her tenure, Keffer instituted street cleaning programs, targeted walkability improvements, and prioritized the development of additional public spaces (Saffron, 2021).

Housing was a priority issue for the Keffer Administration. Mayor Keffer worked to improve existing rental units through the Home Improvement Code Compliance Program (Saffron, 2021). Additionally, the Mayor led the charge to establish a Planning Commission to include residents in the community development process (Saffron, 2021). Before the 2021 ordinance that created Upper Darby's planning commission, the Township was Pennsylvania's largest municipality without a planning commission (Keffer, 2021).

Still, Upper Darby leaders are playing catchup in the creation of 21st-century housing policy. Previous Township administrations took a status-quo approach to housing policy (Saffron, 2021). As a result, Upper Darby's rental boom was not complemented with the right scale of policies and programs to protect Township tenants.

Multiple departments are responsible for housing policy in the Township. Upper Darby's Director of Economic and Community Development Rita LaRue and Director of Administrative Services Scott Alberts serve as the Township's key decision makers on housing matters. Township employees in departments that include Zoning, Code Enforcement, and Community Engagement are tasked with delivering services to tenants.

Housing policy in the Township stands at a critical juncture. Newly elected Mayor Ed Brown listed "safe, decent, and affordable housing" among his key priorities for governance (Cooper, 2023). Township leaders now have a window of opportunity to enact policies that leverage rental reforms as a pathway to increased tenant stability, public and environmental health, and public safety.

IV. Problem Background:

Reverse Redlining and the Great Recession:

Diversity is a strength of Upper Darby. However, non-white Upper Darby residents have faced challenges accessing safe, affordable housing.

Upper Darby diversified during a period some scholars called “reverse-redlining” (Rheingold, et al., 2001). In 1998, subprime loans comprised 51 percent of refinanced mortgages in non-white communities, relative to 9 percent in white communities. The higher home interest rates given to non-white homeowners were a precursor to higher home foreclosure rates. Between 2006 and 2010, 11.6% of Hispanic-owned mortgages and 9.8% of Black-owned mortgages ended in foreclosure (Aguirre & Martinez, 2013). This was relative to the 5.1% foreclosure rate of white homeowners.

Upper Darby’s population diversified during this period of housing instability across the United States. In 1990, Upper Darby’s population and schools were over 90 percent non-Hispanic white (Martin, 2020; U.S. Census Bureau, 1992). By 2020, nonwhites composed almost 60 percent of the township’s population (U.S. Census Bureau, 2020). Although Census Data does not track homeownership rates by race at the Township level, we should assume non-white homeowners in Upper Darby were affected by national trends.

The 2008 mortgage crisis brought a new entrant to the rental housing market: large, corporate landlords. Between 2011 and 2013, private equity firms purchased 350,000 properties foreclosed during the housing crisis (Higgins, 2021). The growth in corporate possession of rental properties came at the expense of “mom and pop” landlords. While individual owners bought over 80 percent of single-family homes before the recession, that share dipped to under 53 percent between 2013 and 2015 (Lee, 2017).

The growth of corporate and out-of-town landlords has spurred concerns over housing disinvestment. A study of housing violations found a statistically significant connection between Limited Liability Company (LLC) ownership of rental properties and rates of code violations (Travis, 2019).

The Great Recession redistributed all homeownership. Hundreds of thousands of non-white-owned properties are now rented out by non-individual landlords.

Northeast Philadelphia’s Mayfair neighborhood is the most studied case of absentee landlords in Upper Darby’s metropolitan region. Mayfair community members complained that rental properties that lacked local property managers became sources of complaints for noise, blight, and crime (Reardon, 2010). The Mayfair Civic Association investigated the deeds on one block that had been a sore spot in the neighborhood and found seven properties registered to absentee landlords with New York addresses (Reardon, 2010).

The affordability of single-family homes made it possible for out-of-town landlords to buy up large swaths of property (Reardon, 2010). Upper Darby Township officials have seen trends similar to those in Mayfair. The rise of out-of-town landlords converting single-family homes into rental units in Upper Darby Township frustrated the very residents who replaced their long-time incumbent mayor with Barbarann Keffer in 2020 (Saffron, 2021).

Rent Burden in Upper Darby:

As of the 2020 census, an estimated forty-five percent of residential properties in Upper Darby Township are occupied by tenants (U.S. Census Bureau, 2020). However, due to errors in the 2020 Census, this figure is a statistical undercount (U.S. Census Bureau, 2022).

At least 39% of the Township's population. Lives in rental units Upper Darby tenants are diverse; over 60% of renters in the Township are non-white (U.S. Census Bureau, 2021).

Renters in the Township have significantly lower incomes than homeowners. Households with mortgages have median incomes near \$80,000, compared to \$42,000 for renter-occupied households (U.S. Census Bureau, 2021).

Although homeowners and tenants have housing costs, the return on investment is unequal. While mortgage payments are a pathway to building generational wealth, rental payments are an unappreciating transfer payment. Additionally, renters who pay more of their income towards housing will have fewer resources to save for a mortgage, let alone cover the cost of minor home repairs in the case of an absentee landlord.

For lower-income residents in Upper Darby Township, the rates of rent burden are the highest.² Table Two details the relationship between rental household income and rent burden.

Table Two: Rent Burden by Income Bracket (U.S. Census Bureau, 2021)

Income Bracket	Households in Bracket	Households Rent-Burdened	Percent Rent-Burdened
Less than \$20,000	3,084	3,028	98.18%
\$20,000-\$34,999	1,889	1,776	94.02%
\$35,000-\$49,999	2,880	1,784	61.94%
\$50,000-\$74,999	2,714	440	16.21%
Over \$75,000	3,464	20	0.58%
Total	14,031	7,048	50.23%

While more than half of Township renters are rent-burdened, the cost burdens are not evenly spread across income levels. This is above the national average, which is roughly 43% (Cromwell, 2022). More than 96% of tenants with incomes under \$35,000 are rent-burdened (U.S. Census Bureau, 2021). Upper Darby's least well-off residents live without margin.

² The United States Department of Housing and Urban Development (HUD) considers renters spending over 30 percent of income housing costs as "rent burdened" (Elsasser-Watson et al., 2020).

Problem Consequences:

Three consequences emerge from more renters living in older properties: risks to property conditions, health hazards, and public safety concerns.

American Housing Survey data demonstrates that property age is correlated with higher levels of inadequate or severely inadequate components of key home infrastructure (U.S. Census Bureau, 2015). Specifically, older homes will require more care to ensure safe water, heating, electrical, and plumbing infrastructure (U.S. Census Bureau, 2015).

Additionally, older properties have higher rates of environmental hazards, most notably lead, mold, and must (Ganesh et al., 2017; Vesper et al., 2020). Elevated blood levels in children yield significant differences in education achievement, early incarceration, and reliance on public assistance (Coulton et al., 2023). Mold and household dampness are associated with higher rates of common colds, chronic bronchitis, and asthma (Muddari et al., 2016).

Finally, the clustering of older properties on a street segment is also independently associated with higher crime rates. Hipp & colleagues (2018) controlled for dozens of explanatory factors that could influence the homicide rate on a street segment. Despite the kitchen sink of controls implemented, the authors found that when the age of a street segment increases by ten years, the homicide rate increases by 16% (Hipp et al., 2018). The effect of housing age on homicides follows a linear, upward trend (Hipp et al., 2018).

The challenges of Upper Darby's rental market exacerbate the consequences of an older housing stock.

V. Pathways to Policy:

Upper Darby Township has two distinct pathways to policy change that could improve outcomes for Upper Darby's least well-off renters. First, the Township could consider options to transition the Township's older housing stock to newer housing stock.

In this target state, zoning laws would be paired with incentives to promote the construction of new affordable units. Four potential alternatives could aid the Township's progress:

1. **Repurpose Vacant Land:** Almost six percent of Upper Darby's properties are vacant (U.S. Census Bureau, 2020). Upper Darby could create a land bank to acquire, control, and equitably redevelop vacant land. Case studies from Albany, New York, Columbus, Ohio, and Houston, Texas demonstrate that land banks, when combined with Community Land Trusts (CLTs) increase the number of available affordable units (Lowe et al., 2022). The Township can also aid local housing authorities and non-profits in purchasing foreclosed or vacant properties. Following the 2007-2008 mortgage crisis, Broward County, Florida faced an 86% shortage in affordable rental housing (Walter et al., 2014). Consequently, Broward County leveraged a GIS tool to help housing agencies and non-profits relist foreclosed properties as rental units (Walter et al., 2014).
2. **Loosen Regulations to Supercharge Housing Construction:** Two researchers simulated the market effects of massively increasing housing production in Los Angeles. They found that increasing housing supply at the 90th percentile rate was associated with eight times more net benefits than doubling low-income housing tax credits (Cornith and Irvine, 2023). Additionally, increasing the housing supply was found to produce an 18.1% decline in rental prices (Cornith and Irvine, 2023). The increase in supply was also projected to increase access to Section VII assistance for eligible individuals by 23.8% (Cornith and Irvine, 2023).
3. **Incentivize Affordable Unit Construction:** Inclusionary zoning regulations require new housing units to be rented at affordable rates. These regulations are often paired with density bonuses, which allow developers to build more units than permitted. Studies of the Portland and Seattle Metropolitan areas found a 1% increase in housing density is associated with a 0.38% increase in affordable units (Aurand, 2010).
4. **Increase Mixed-Use & Transit-Oriented Development:** Studies of mixed-use and untraditional units' construction in Portland and Seattle found that mixed-use development yields positive outcomes. Aurand (2010) found that mixed-use and untraditional development led to a statistically significant 6.3 percentage point increase in the *share* of affordable rental units. The study also identified a statistically significant decrease in the magnitude of unaffordable units for low-income renters (Aurand, 2010)

On the other hand, Upper Darby could also work to improve the condition of *existing* units. Multiple municipalities have instituted programs that could be replicated in Upper Darby.

1. **Home Repair Programs:** Philadelphia's Basic Systems Repair Program (BSRP) provided grants of up to \$20,000 to homeowners in need of emergency repairs. Blocks where a home received a BSRP repair experienced a 21% decrease in crime after the repair relative to blocks with similar crime rates before the project began (South, et al., 2021). Philadelphia has now expanded this offering with a Rental Improvement Fund (RIF) (Bond, 2023). The RIF offers forgivable loans to small or "mom-and-pop" landlords who make repairs similar to those completed in the BSRP project.

2. **Enhanced Code Enforcement:** Code enforcers are “super controllers,” street-level bureaucrats whose presence promotes greater public order. A study of six cities found that increased code enforcement activity on a block was correlated to decreased crime rates (Tillyer et al., 2022). Additionally, a study of code enforcement practices in Boston, Massachusetts found a relationship between code inspections and the remediation of pulmonary illness triggers (Lemire, et al., 2022).
3. **Implement Nudges to Increase Compliance:** Three Randomized Control Trials evaluated mechanisms to improve the efficiency of code enforcement in New Orleans, Louisiana, Louisville, Kentucky, and Chattanooga, Tennessee. When implemented concurrently, the nudges could save a city agency between six and fifteen percent of its code enforcement budget (Linos et al., 2019).

Both policies to increase the volume of affordable rental properties and the quality of existing units are backed by robust evidence. However, to implement the zoning reforms needed to add more affordable units, Upper Darby will need to develop a new zoning ordinance. To provide Upper Darby with immediately implementable recommendations, this project will focus on how the Township can improve the quality of its *existing* housing stock.

Nonetheless, when Upper Darby next updates its zoning code, the options outlined above are all worthy pursuits. Of those options, a type of mixed-use development – **Transit-Oriented Development (TOD)** – stands out as a fruitful planning strategy for Upper Darby to pursue. Over 35,000 individuals pass through Upper Darby’s 69th Street Transportation Center daily, making it the most used multi-modal transit stop in the Philadelphia Metropolitan Area (Moran, 2019). Leveraging the multitude of transit nodes that crisscross the Township for future development should be a top strategic priority for the Township’s next zoning ordinance.

VI. Alternatives & Criteria Overview:

Upper Darby Township can weigh three rehabilitation-based approaches. These alternatives leverage three different policy approaches: incentives, super controllers, and nudges.

1. **Provide Forgivable Loans to Small Landlords:** this alternative mirrors Philadelphia's Rental Improvement Fund (RIF). This program would disburse property improvement loans ranging from \$10,000 to \$25,000 to small, individual landlords.
2. **Hire Two Additional Code Enforcement Inspectors:** Upper Darby can hire two additional code enforcement inspectors to increase the frequency of rental inspections.
3. **Implement Nudges to Encourage Code Enforcement Compliance:** Upper Darby can employ a well-tested behavioral intervention to nudge previously delinquent landlords to comply with Township Code (Linos, et al., 2019).

Evaluative Criteria:

In choosing the best policy path for Upper Darby, four questions should be asked:

1. What are the costs of each project for the Township and society?
2. Can we be *confident* that the project's benefits will exceed the costs?
3. How are the outcomes of the policy distributed?
4. Will this policy be easy for the Township to implement relative to other options?

These questions offer us four decision rules and shape the four criteria listed below that each alternative will be filtered through.

Cost will answer our first decision rule: the costs to the Township and Society. The sum of the Township's expenditures offers a total Marginal Public Opportunity Cost (MPOC). The MPOC is the sum of the present value of the Township expenditures multiplied by 20%. As government funds can always be spent on other worthwhile programs, all Township expenditures are multiplied by a 20% Marginal Cost of Government Funds (MCGF) multiplier. The MCGF multiplier captures the opportunity cost of Upper Darby's spending.

Each project also imposes opportunity costs on landlords, tenants, or both. In this Benefit-Cost Analysis of rental reforms, the opportunity costs distributed to both landlords and tenants have standing. These costs will be added to the MPOC to compute our total Marginal Social Opportunity Cost (MSOC), which represents the full cost of each policy. These values will be presented as a Net Present Value using 2023 dollars.

The Net Present Values are computed leveraging new federal guidance on regulatory analysis (The Office of Management and Budget, 2023). My assessment and incorporation of this guidance contained in the Office of Management and Budget's Circular A-4 is detailed in Appendix A ("Interpretation to Revisions of Federal Regulatory Guidance). Primary calculations will be reached using OMB's recommended 2% discount rate.

Benefit-Cost will resolve our second decision rule: confidence that the benefits of each policy will exceed the Marginal Social Opportunity Cost. All calculations are detailed in Attachment A ("Benefit-Cost Analysis") linked to this report.

This analysis measures each project's estimated effect in remediating the three central consequences of the problem: risks to public safety, risks to pulmonary health, and elevated administrative burden. Successful alternatives will reduce the risk of crime, prevalence of illness, and increase Upper Darby's operational capacity.

To measure these benefits, this analysis will rely on estimates that compute the values of crime reductions, disease costs, and administrative efficiency gains. In a market, these values demonstrate what agents should be willing to pay to receive these benefits. The total benefit values should be best understood as Upper Darby's total Marginal Willingness to Pay (MWTP) to acquire these benefits.

Within Benefit-Cost, three values, or decision guides, will be provided: the primary Net Present Value, the primary Benefit-Cost Ratio (BCR), and the NPV of Median Simulated Outcome. The NPV and BCR are computed at the OMB's recommended 2% discount rate. The NPV of the Median Simulated Outcome is the product of a detailed sensitivity analysis. Of the three, the NPV of the Median Simulated Outcome is given the most weight as it will tell us with confidence if the project's positive value should be considered robust to error.

This project's sensitivity analysis is rooted in three principles. First, factors from Upper Darby's crime rates to the likelihood of early code compliance are not easily predictable, unmovable variables. These variables are highly variant, which provides an opportunity to use simulations to exploit this variance.

Second, while risk reductions are of value, it is also helpful to know if the benefits will actually be received. For all values that had an outcome coefficient under one, the benefit value was calculated as a probability instead of the original MWTP for reductions in risk.

Finally, as an additional robustness check, the outcomes were simulated at three additional discount rates: 1.7%, 3%, and 7%. The 1.7% rate represents the low-bound that OMB considered using in the draft of Circular A-4 (Office of Management and Budget, 2023). The 3% and 7% rates mark the discount levels used in Benefit-Cost Analysis before the updated circular.

Each alternative was simulated 10,000 times at each interest rate, providing 40,000 total simulations for each alternative. The full process used in sensitivity analysis is detailed in Appendix G ("Strategy in Sensitivity Calculations & Simulations"). Additionally, the strategies used to calculate the Public Safety and Public Health benefits are located in Appendix B ("Empirical Strategy in Isolating Public Safety Benefits") and Appendix C ("Empirical Strategy in Isolating Health Benefits"). As with the public safety benefit, these risk reductions were simulated as probabilistic outcomes in the sensitivity analysis.

Equity answers our third decision rule: how – or to whom – are outcomes distributed? As more than half of Upper Darby tenants are already cost-burdened, an effective policy outcome will prevent additional rent burden. This project relies on a novel quantitative equity measurement motivated by the Kaldor-Hicks Tableau framing (Krutilla, 2005).

Each project's equity score will be measured by the following equations:

$$\text{Equity of Project} = \frac{\text{Benefits Accessible to Tenants}}{\text{Total Opportunity Cost}}$$
$$\text{Benefits Accessible} = \text{NPV(Health Benefits)} + \text{NPV(Public Safety Benefits)}$$

The opportunity costs of landlords are considered for all projects, as these costs either impact small landlords or pose costs that could be passed onto tenants. The equity score will be used to compare how different alternatives distribute costs and benefits.

Administrative Feasibility resolves our final decision rule: ease of implementation relative to other options. Three factors mold administrative feasibility: project resourcing (staffing), project ordering, and capacity-building potential. Of these factors, project resourcing is the most important consideration. Based on consultations with the Township, each project was rated on the scale of *high* (highly feasible), *medium*, or *low*.

VII. Alternative 1: Small Landlord Repair Program

Upper Darby can implement their version of Philadelphia's Rental Improvement Fund (RIF). Under this program, Upper Darby Township will provide loans to landlords for critical home repairs.

Philadelphia's RIF has used two loan types: a forgivable loan scheme for repairs under \$25,000 and a zero-interest loan for repairs costing between \$25,000 and \$50,000 ("Rental Improvement Fund"). This alternative is limited to the forgivable loan structure. Landlords who follow the process listed in Appendix E ("Rental Improvement Fund") would be eligible to receive the loan forgiveness. Although the benefits of Philadelphia's program is too new to evaluate, the demand for the service is robust (Bond, 2023).

Philadelphia has invested \$9 million into the program (Bond, 2023). Funding sources include Pennsylvania's Whole-Home Repairs Program and Philadelphia's Neighborhood Preservation Initiative (Bond, 2023). This alternative resizes that investment to account for population differences. Projections for Upper Darby are based on spreading \$800,000 in loans over five years. Upper Darby would finance this program through Community Development Block Grant funds (*Title 42 - the PUBLIC HEALTH and WELFARE CHAPTER 69 - COMMUNITY DEVELOPMENT Sec. 5305 - Activities Eligible for Assistance*, 2010).

Cost: Loan expenditures, administrative costs, and opportunity costs comprise the factors that will provide the value of the Marginal Public Opportunity Cost (MPOC) and the Marginal Social Opportunity Cost (MSOC).

Loan Expenditures to Landlords: this program funds \$160,000 in forgivable loans to small landlords each year for five years. This expenditure will be subject to the Marginal Cost of Government Funds (MCGF) multiplier.

Administrative Costs: This program will require substantial resourcing from multiple Township departments. All wage data reference the Bureau of Labor Statistics' prevailing wages for the Philadelphia-Camden-Wilmington Metropolitan Area (Bureau of Labor Statistics, n.d.). A more detailed breakdown of administrative cost assumptions can be found in Appendix F. Table Three provides the breakdown of Administrative Costs for the Home Repair Program.

Table 3: Administrative Cost Breakdown, Home Repair Program (Bureau of Labor Statistics, n.d.).

Position:	Time Equivalent:	Cost:
Code Enforcement	Three inspections in repair year annual inspections for loan period.	\$31.25 per hour/inspection
Program Management: Senior Manager	25% FTE of Social & Community Service Manager (Yrs. 0-5); 5% FTE (Yrs. 6-15)	\$84,520
Program Management: Manager	50% FTE of Community & Social Services Specialist (Yrs. 0-5); 10% FTE (Yrs 6-15).	\$52,900
Finance Administration: Loan Servicing	5% FTE of Accountant (Yrs. 1-15)	\$87,000
L&I Administration: Permit Management	10% FTE of Office Administrator (Yrs. 0-5)	\$41,890

Opportunity Costs: Opportunity costs come from three sources: preparing applications, managing repairs, and forgoing rent increases. As loan applications require contractor bids and permits, each completed application is calculated at fifteen hours of time for each landlord applicant. It is assumed that 0.5% of rental properties will apply for a loan a year and eight properties will receive the loan. The time cost is derived from the hourly area prevailing wage rate of Property Managers (Bureau of Labor Statistics, n.d.).

The difference in average annual rental increases versus the increase rate for program recipients is also included as an opportunity cost for ten years. To provide a high-bound estimate, the median gross rent in the one-year 2022 ACS for Upper Darby Township is used (U.S. Census Bureau, n.d.). The percentage point increase in rent since 2017 divided by five years is used to calculate the expected annual rent increase (U.S. Census Bureau, 2017-2023). Due to the small difference in Upper Darby rent increases and the loan caps, even when compounded, it is assumed that 100% of landlords will opt for loan forgiveness. In the sensitivity analysis, a 10% failure rate for each project is simulated.

With these parameters, the estimated Marginal Public Opportunity Cost (MPOC) to Upper Darby Township is **\$1,659,278.83**. The total Marginal Social Opportunity Cost (MSOC) for this project is **\$1,781,754.07**.

Benefit-Cost: Benefit calculations comprise the Marginal Willingness to Pay (MWTP) for improved safety, health, and administrative outcomes. As other benefits from mental health to aging-in-place could emerge from this program, this estimate should be considered a low-bound.

Public Safety Benefits: This benefit calculates the MWTP for improved public safety outcomes using a measure of the Social Cost of Crime (McCollister, et al., 2010). Social Cost of Crime estimates combine victim costs, criminal justice system costs, career criminal costs, and intangible costs (McCollister, et al., 2010). All figures in this analysis are in 2023 dollars.

Full details of the empirical strategy to calculate Public Safety benefits can be found in Appendix B, though the following parameters merit further emphasis:

- This analysis benefitted from an evaluation of Philadelphia’s Basic Systems Repair Program (BSRP). The BSRP ran from 2006-2013 and provided homeowners with \$20,000 loans for improvements to plumbing, electrical, heating, and structural issues (South et al., 2021). As Upper Darby’s housing stock bears remarkable similarity to its neighboring city, the BSRP findings are assumed as externally valid.
- For each home that participated in the BSRP, that home’s *block* enjoyed a 21% reduction in total crime with greater reductions in some types of crime (South et al., 2021).
- The total number of blocks was found using the number of street centerlines in an ArcGIS map of the Township’s garbage collection route (Upper Darby Township, 2021).

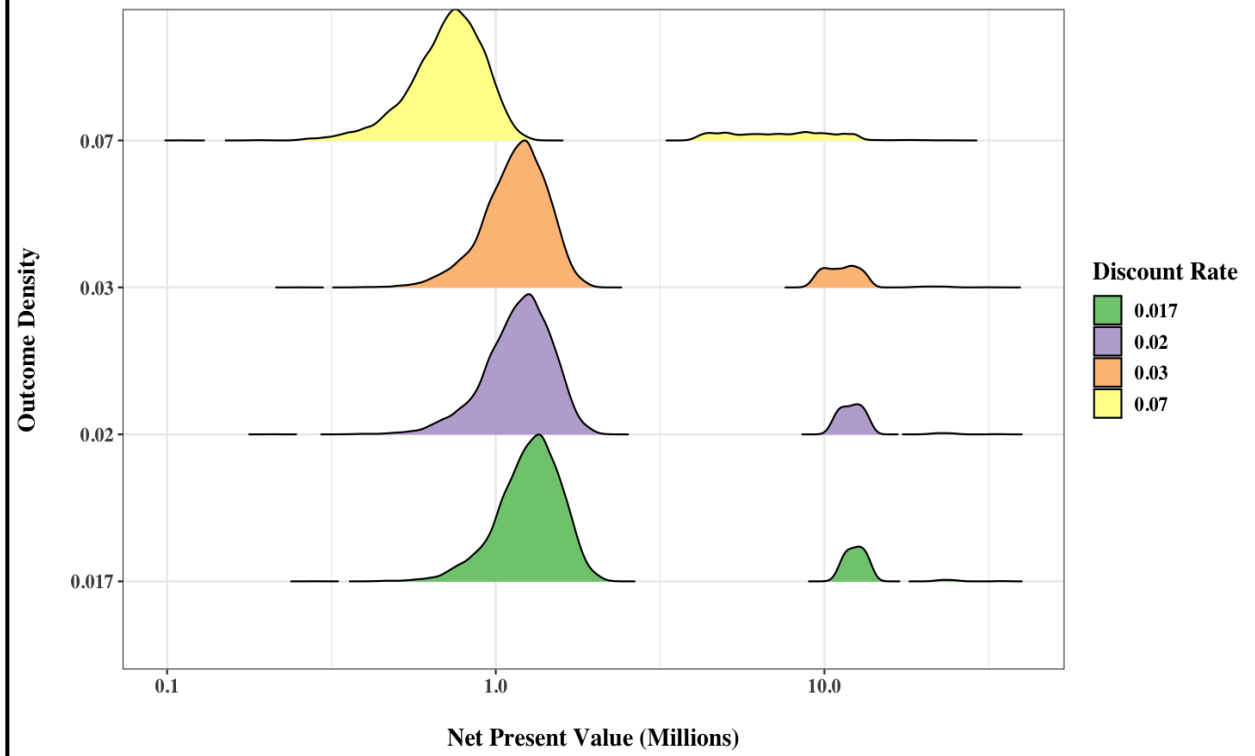
Public Health Benefits: The health benefit computes the MWTP for the reduction in pulmonary illness. Specifically, decreased levels of Allergic Rhinitis (AR), Chronic Bronchitis, and annual asthma diagnoses are evaluated. A variety of existing scientific literature was used to determine the expected prevalence of each illness. The health benefits of each home repair is also expected to have a ten-year benefit. The full empirical strategy used to calculate public health benefits is detailed in Appendix C. The following constraints are of particular note:

- Final loan funds will not be released until the house is compliant with Township Code. A 100% compliance rate for repaired properties. However, if the home did not receive a repair, it would still be inspected every three years with an expected 24.2% remediation rate for asthma triggers. As a result, the reduced risk of pulmonary illness is calculated as a $1-(24.2\%)$ (Lemire et al., 2022).²

Administrative Benefits: The loan program can turn properties with code violations into code compliance. New Orleans, Louisiana valued each early compliance at \$402 in 2019 terms (Linos, et al., 2019). This estimate included costs that ranged from time savings to decreased court costs. The MWTP for this administrative benefit is calculated in 2023 dollars with the assumption that 75% of the loans will target properties out of compliance.

The *Net Benefits* equate to **\$6,041,846**. Most benefits come from impacts on public safety. As a result, the estimated *Net Present Value* of the Small Landlord Repair Program is **\$4,260,092**. The *Benefit-Cost Ratio* for this project is approximately **3.39:1**. However, the *Median Simulated outcome* is **\$1,223,358**, due to the wide variance in the public safety benefit. Nonetheless, at every discount rate, every simulated outcome was positive. Figure 2 offers a ridgeline plot that demonstrates the robustness of the Home Repair program following 40,000 simulations.

Figure 2: Ridgeline Plot of Simulated Home Repair Outcomes



Equity: The ratio of benefits accessed by tenants to opportunity costs borne by tenants and landlords is **49:1**. This high equity score is unsurprising. The loans benefit landlords who already rent their properties at an affordable rate for working-class families. The rent increase cap that accompanies the loan will also prevent opportunity costs from being levied on low-income property owners. Additionally, the benefits to health and public safety either benefit families in affordable units or their neighbors. Overall, there should be confidence the distribution of benefits in this alternative is spread equitably.

Administrative Feasibility: This program will require significant resourcing from multiple Township departments. Though some speed bumps could be mitigated by incorporating lessons learned by Philadelphia’s RIF, this program is administratively challenging. Additionally, these risks may be further reduced by implementing one of the other alternatives first. Nonetheless, if implemented well, this program’s intricate management needs will build the enterprise capacity of Upper Darby. Still, administrative feasibility ranks *low*.

VIII. Alternative Two: Additional Code Enforcement

Upper Darby Township can hire additional code enforcement staff to increase the volume of annual rental inspections. Currently, rental inspections are under the purview of five L&I inspectors who clear a combined one-third of rental units annually. In this policy option, the Township could hire two additional code enforcers. Annual enforcement frequency is assumed to grow by 40.6% with additional hires.

Cost: The cost of additional code enforcers yields both administrative and opportunity costs:

Administrative Costs: This policy will fund two additional code enforcement positions at 100% FTE for five years. Wages will be computed using the mean area prevailing wage for a building inspector and multiplied by the MCGF. (Bureau of Labor Statistics, n.d.).

- To resource these staff members through their work with the Township, an additional 25% FTE of an L&I administrator using the same wage parameters as Alternative One.
- A training cost will be levied in Year 0. This cost is calculated as one month's pay for three code enforcement positions – two of those positions being new hires and the other to represent the time cost of training new staff.

Opportunity Costs: When code violations are remediated, the costs of repairs are passed onto tenants. A study of code enforcement resolutions in Chicago found that a 10% increase in resolved violations is associated with a 5.52% increase in rent for units that corrected code violations (Bartram, 2019). The Opportunity Cost to tenants is included in Years 2-6. Linos & colleagues (2019) studied the compliance rates at properties with past code violations and found that 78.5% were compliant during random inspections. To derive a low-bound estimate, the compliance rate for past code violators was applied to all properties. The following assumptions were also made:

- Data on code violations per Philadelphia street segments were multiplied by total street segments in Upper Darby and adjusted for differing inspection frequencies (Tillyer, et al., 2022). Most inspections in Upper Darby are of rental properties. It is assumed that 75% of violations are given to rental units to place a lower-bound estimate on the benefits. This analysis also assumes a steady relationship for the average number of homes on a street segment to provide a low-bound finding.
- It is also assumed that each unit of repair will also cost a landlord one hour of time, which will be multiplied by the median hourly prevailing wage for Property Managers. The time cost of repair will be computed in Years 1-5.
- This program may also cause an increase in housing instability, forced moves, increased need for social services, and potentially, temporary homelessness. As these projections are not available, the MSOC estimate should be considered a low bound.

The Marginal Public Opportunity Cost to Upper Darby Township is **\$1,245,853**. The total Marginal Social Opportunity Cost is **\$1,809,157**.

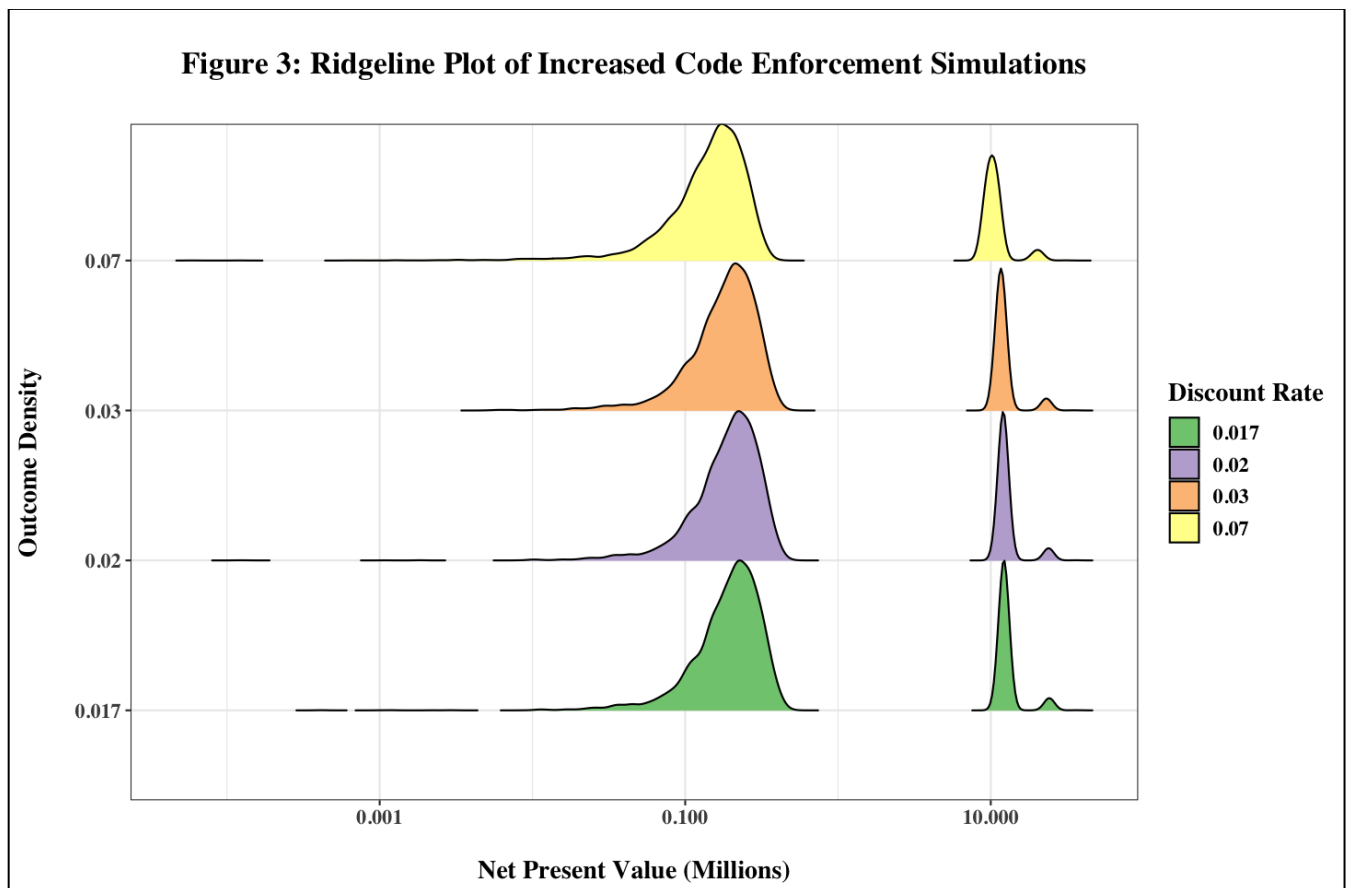
Benefit-Cost: Public safety and public health benefits will determine the MWTP and combined with the MSOC, offer the project's NPV, BCR, and Median outcome. There are no administrative benefits calculated, as this program is not expected to produce additional early compliance.

Public Safety Benefit: there are documented public safety benefits associated with an increase in Code Enforcement activity in a census tract. Tillyer & colleagues (2022) calculated public safety benefits for a 1% in code enforcement activity per street segment (or city block) (Tillyer et al., 2022). The public safety benefit is calculated on a one-year lag (Years 2-6). Additional details on the empirical strategy can be found in Appendix B.

Public Health Benefit: As with the public safety benefit, the pulmonary illness benefit is now calculated using the strategy for a yearly average benefit for adults for five years. Additional details about these calculations can be found in Appendix C.

The total benefit to society for this project is **\$6,368,529**. As a result, the Net Present Value of this alternative is **\$4,559,372**. The ratio of benefits to costs is **3.5:1**. However, due to wide variance in the public safety and public health benefits, the median simulated outcome is only **\$224,602**.

Additionally, 0.685% of simulations result in outcomes with negative Net Present Values. While that probability is small, it would likely grow if unobserved costs – such as housing instability, forced moves, and temporary homelessness – were measured. Figure Three shows the range of outcomes on a ridgeline plot.



The above plot demonstrates that the value of the Code Enforcement is difficult to predict. While many outcomes are positive, the combination of negative simulated variables and omitted costs demonstrate this project may not be robust to errors.

Equity: The ratio of benefits accessed by tenants to opportunity costs is only **13:1**. Due to landlords likely transferring the repair costs into rental price increases, the costs of the project are largely absorbed by tenants. This is without considering other unmeasurable effects including forced moves, increased public assistance needs from additional code enforcement, and potentially, temporary homelessness. Compared to other alternatives, this option is not equitable.

Administrative Feasibility: This alternative's implementation will require onboarding two more staff members. While the administrative strain of new hires is not equal to building a new program, the costs of new staff are non-negligible. Additionally, ambitiously increasing code enforcement activity will generate a higher level of backlash from landlords and potentially, the tenants this program aims to help. This alternative will offer a limited capacity-building benefit, as it could resource inspectors who could aid the implementation of the Home Repair Program. However, it does not offer the same enterprise resource benefit as the other options. Given these considerations, the administrative feasibility of this project is **medium**.

IX. Alternative Three: Nudge-Based Code Enforcement

Monetary fines for bad behavior are a centuries-long practice. However, their efficacy is questionable. Two social psychologists ran an experiment to test the effectiveness of fines at a preschool. The preschool was frustrated with parents picking up their children late. As a result, the preschool started fining these tardy parents (Gneezy & Rustichini, 2000).

The fine had the opposite effect from what the preschool intended. With the fine, late pickups actually increased (Gneezy & Rustichini, 2000). When the fine was removed, there was no further increase in late pickups (Gneezy & Rustichini, 2000). These results led the authors to pithily conclude that “a fine is a price” (Gneezy & Rustichini, 2000).

Many behavioral economists have suggested replacing fine-based approaches with nudge-based approaches. Nudges are interventions where “choice architects” leverage knowledge of social psychology to help individuals make better decisions (Thaler & Sunstein, 2008). Nudges have been attempted in a variety of policy settings to encourage responsible retirement planning, cleanliness of public spaces, and yes, code enforcement.

In a Randomized Control Trial, three cities benefitted from employing nudge-based interventions to promote compliance with building codes (Linos et al., 2019). Upper Darby can employ one of these interventions in nudging some of the Township’s most delinquent landlords toward compliance with code enforcement.

This intervention would be modeled on the Randomized Control Trial attempted in Chattanooga, Tennessee. The researchers mailed postcards to 3,000 properties with past code violations to residents of coming inspections (Linos, et al., 2019). A copy of the postcard sent in the previous experiment is provided in Appendix H. While Chattanooga only mailed the postcard to the property to be inspected, it is recommended that Upper Darby send the postcard to the property *and* to the landlord’s address to maximize policy effectiveness.

The Chattanooga experiment found that the treatment group was about 1.91 percentage points more likely to comply with code enforcement (Linos, et al., 2019). The number of days that passed since their previous violation was also associated with much higher compliance. To compute the total benefit, this project assumes a low-bound 1,095-day lag.

As this project is not expected to require any dependence on external revenue streams, it will be assumed that this policy will continue in perpetuity. Still, to enable comparison with other options, this project will be evaluated on a fifteen-year horizon.³

Cost: This policy requires the valuation of administrative and opportunity costs, similar to those posed in Alternative Two.

Administrative Cost: The administrative costs of this project comprise of a small staffing cost and a postage cost. Both costs are multiplied by the MCGF multiplier.

³ If we were to calculate the administrative benefit in accounting terms (without opportunity cost or MCGF) as a perpetuity ($PV = \text{benefit}/\text{interest rate}$) the NPV of the administrative benefit would be equal to $[(\$45,766 - \$4,532)/0.02]$ or \$2,061,700.

- This program will require 5% FTE of an L&I office Administrator. This individual will pull the records of properties scheduled to be inspected each year to mail warning postcards.
- This program will also requires postage costs. This will be calculated by multiplying the number of properties targeted by the USPS postcard mailing rate, currently \$0.53 (United States Postal Service, n.d.). In consultation with Township Administration, a low-bound of 62.5% of properties were assumed to have had a past code violation.
- This program does not require more Code Enforcement Staff. The value of this program is that it yields more enforcement through *efficiency* as opposed to *volume*.

Opportunity Cost: In this alternative, it is assumed repair costs will continue to be passed down from landlords to tenants via rent increases. The estimated increase in corrected violations and time spent doing so will again yield the costs of increased rent. This cost will begin in Year 2.

Overall, the total cost of this alternative is **\$102,452** to the Township. When opportunity costs are added, the total MSOC of this project is **\$166,889**.

Benefit-Cost: Once again, three benefits will be considered in this analysis: administrative benefits, health benefits, and public safety benefits. In this alternative, benefits are derived from the expected growth of completed property inspections derived from the compliance gains generated by the policy.

Public Safety Benefit:

- The public safety benefit is derived from expected growth in Code Enforcement efficiencies. Additional first compliances will allow inspectors time to conduct additional property inspections elsewhere in the Township. These efficiency gains can be computed as a percentage increase in code enforcement activity.
- Additional steps taken to isolate the nudge effect can be found in Appendix B.

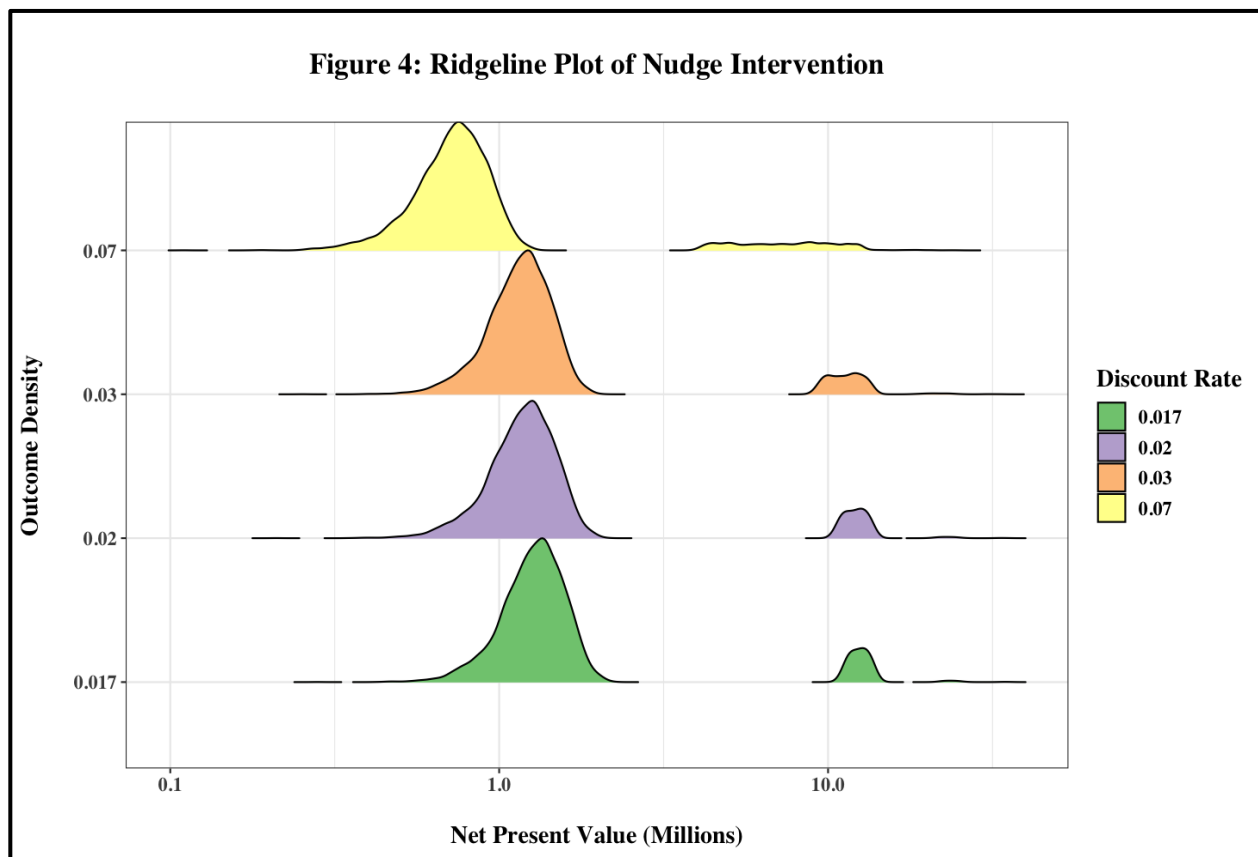
Health Benefit:

- The health benefit is calculated by leveraging additional first compliances as extra properties that Upper Darby Township can inspect each year.

Administrative Benefit:

- Linos & colleagues (2019) estimated that each additional first compliance with code enforcement was valued at \$402 in 2019 dollars. This benefit is valued at approximately \$479 in the 2023 dollars used in this experiment.
- The compliance benefit is then calculated by multiplying the value of early compliances by expected additional early compliances thanks to the project.

Overall, this project will yield **\$2,793,455** in benefits, yielding a Net Present Value of **\$2,626,566**. The Benefit-Cost ratio of this project is **16.7:1**. This benefit is robust when simulated, carrying a median return of **\$1,169,941**. As Figure Four, a ridgeline plot of the nudge simulations demonstrates, the program carries robust benefits at every interest rate.



Although the nudge program produces less value at the 7% interest rate, the fact that the program still produces positive outcomes at this rate should be considered significant. Given the program can continue in perpetuity, the fact that it still produces benefits in heavily discounted future years is evidence of its robustness.

Additionally, this project's *administrative* savings outweigh *administrative* costs. As a result, the Marginal Value for Public Funds is considered infinite (García & Heckman, 2022). Each simulation of this alternative produces an infinite Marginal Value of Public Funds.

Equity: The ratio of social benefits accessible to tenants to opportunity costs that could be passed onto tenants is **34:1**. While some rent increases will occur due to this policy, the magnitude of the effect and opportunity costs are smaller than that of enhanced code enforcement. The distribution of costs and benefits for this policy favors Township tenants.

Administrative Feasibility: This alternative scores **high** in administrative feasibility. Compared to the other projects evaluated, the amount of staffing power necessary to enact the policy is significantly lower. This policy is also unlikely to yield the kind of pushback that a massive increase in code enforcement would generate. Additionally, this alternative offers a capacity-building potential. The data analytics, organizational change management, and fiscal savings Upper Darby will generate will open up more pathways for policy action on housing, public health, and public safety.

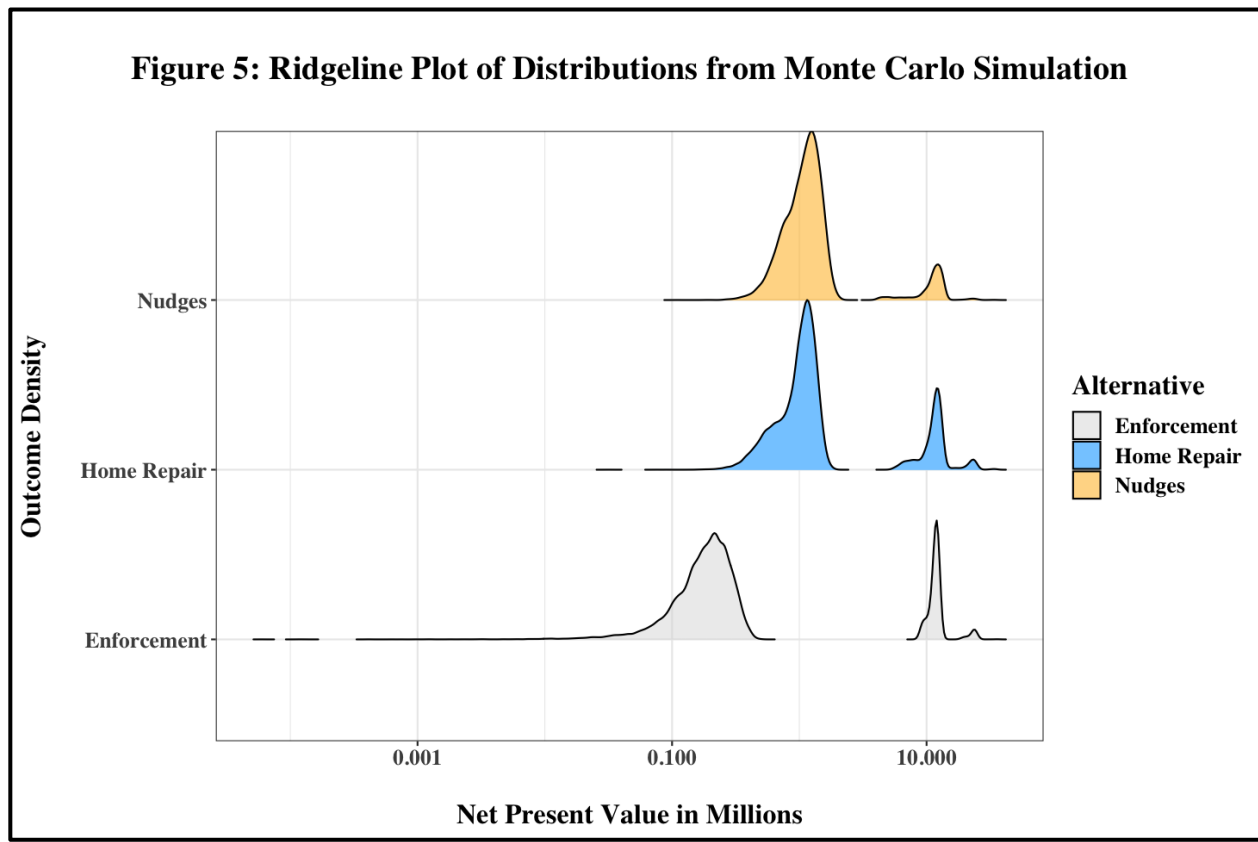
X. Analytical Outcomes:

Table Four lists the outcomes matrix for the alternatives evaluated.

Table Four: Outcomes Matrix

	Small Landlord Repair Program	Additional Code Enforcement	Nudge-Based Code Enforcement
Cost	UDT: \$1,659,279 Total: \$1,781,754	UDT: \$1,205,294 Total: \$1,768,598	UDT: \$102,452 Total: \$166,889
Benefit-Cost	NPV: \$4,260,092 BCR: 3.4:1 Median: \$1,383,152	NPV: \$4,559,372 BCR: 3.5:1 Median: \$224,602	NPV: \$2,626,566 BCR: 16.7:1 Median: \$1,169,942
Equity Ratio	Equity Score: 49:1	Equity Score: 13:1	Equity Score: 34:1
Administrative Feasibility	Low	Medium	High

Figure Five provides the ridgeline plot that shows the range of simulated outcomes.



XI. Recommendations:

All three alternatives can be reasonably projected to generate more societal benefits than societal costs. However, there are marketed differences in the *magnitude* of costs, the *robustness* of outcomes, the *spread* of costs, and the *feasibility* of implementation.

Considering the projected outcomes, I recommend Upper Darby Township immediately implement **Alternative Three: Nudge-Based Code Enforcement**.

This alternative satisfies every decision rule and performs well in each evaluative criterion. The program is low-cost, with robust benefits that are fairly distributed. The nudge program is also the easiest to implement and will build Upper Darby's capacity for future policy action. As this program should pay for itself in short order, the implementation of this alternative does not preclude additional policy actions.

In addition to implementing Alternative Three, Upper Darby Township should continue assessing the viability of **Alternative One: Small Landlord Home Repair Program**. While this program will require a significant administrative and financial commitment by the Township, this program provides robust benefits with minimal risk of negative spillovers to vulnerable residents. Upper Darby Township can also observe the implementation of Philadelphia's RIF to identify pain points and successes to replicate.

Although Alternative Two: Additional Code Enforcement has the highest Net Present Value, the benefit size is not robust in sensitivity analysis. As this alternative has key unobserved costs, the chance of the costs exceeding the benefits is likely understated. This alternative imposes the highest costs on low-income residents and additional costs would also target this group. While one could imagine policies like rent controls for properties with violations to protect residents from these spillovers, such actions could increase property sales, increase Upper Darby's property vacancy rate, and may be overturned in court.

The immediate implementation of Alternative Three paired with planning to incorporate Alternative One will better the quality of life for Upper Darby Township tenants.

XII. Policy Implementation:

The nudge-based recommendation to encourage code compliance will be the easiest for the Upper Darby Township to implement. In implementing this policy, the Township must consider two programmatic considerations, two personnel management considerations, and two long-term planning goals.

1. Programmatic Considerations:

1.1 Address Language Barriers: Upper Darby will have to consider the magnitude of languages spoken in the Township when implementing this policy (Cooper, 2023). If Upper Darby were to solely mail the postcards in English to every household, this policy not achieve its anticipated effectiveness. However, it is not realistic for the Township to customize the language for each recipient. While Upper Darby knows over eighty languages are spoken in the Township, Census Data does not track which languages are the most spoken (Cooper, 2023). Though Upper Darby's motto is "the world in one place," data challenges complicate the ability of Township officials to know how much of what parts of the world are in Upper Darby.

To implement the policy, the Township could begin by fitting four commonly spoken languages on a postcard (English, Spanish, Vietnamese, and Bengali). The postcard would also benefit from having a QR code or a shortened URL that could direct recipients to a webpage on the Township website where they could select which language to read the message in.

1.2 Determine Launch Intensity: While the intervention itself is well defined, Upper Darby Township will still need to make decisions regarding the startup, scaling, and measurement of the proposed policy.

Data collection limitations may create difficulties for the Township in identifying known past code violators. While these challenges will be eased by the Township's software modernization effort, this may complicate the Township's short-term launch of the policy. However, multiple solutions remain at the Township's disposal to implement the policy in a way where effectiveness can be measured.

First, the Township could market-test the intervention with a smaller set of properties.⁴ This would build in a change control for the Township to make modifications to the intervention. Additionally, the Township could act to mail postcards to every rental household scheduled for inspection. While the effect size may be smaller for compliant properties, the only real cost to expanding this policy would be monetary.⁵

Regardless, the Township will need to make decisions during the launch of this policy to ensure that the effects of the way the Township administers the policy can be measured.

⁴ A sample of 500 properties – half who receive the postcard and half who do not is recommended to draw any kind of significant conclusions from market testing.

⁵ Mailing postcards to all households – would bring an accounting cost of \$1,632 a year. Mailing the postcard to all rental households the year of inspection would cost roughly \$3,264 a year.

2. Personnel Management Considerations

2.1 Effective Database Management: The program's success will not be possible without the tools necessary to track previous code violations, process the intervention, and monitor its success. At present, Upper Darby Township is implementing a new centralized data management system (OpenGov) to replace a decades-old legacy management system. As this intervention requires coordination from multiple departments, there must be a Single Source of Truth (SSOT) where all documentation of this program can be shared. For this intervention to succeed, Township employees will need to embrace OpenGov once implemented.

The nudge program also could yield greater capacity-building dividends for Upper Darby. The procedures needed to run and measure the program will unlock the kinds of advanced analytics use cases that will enable increased efficiency in Township management.

2.2. Strategic Change Management: A portion of encouraging effective data management is the execution of effective change management. Since the pandemic, employees everywhere have been asked to absorb higher volumes of change and to implement those changes at a higher velocity (Morain & Aykens, 2023). Unsurprisingly, employees are reporting change fatigue. A Gartner Research study found that in 2022, 43 percent of employees described themselves as willing to support enterprise change (Morain & Aykens, 2023). This is a sharp decline from 2016, when 74 percent of employees described themselves as willing to support enterprise change (Morain & Aykens, 2023).

Township staff and all impacted stakeholders impacted by the policy need to be an active part of change management efforts. The Township should build both a communications and project management plan as a part of this implementation. Implementing this policy alongside the build of an enterprise system will require coordination to ensure that employees are not overwhelmed by the volume and velocity of changes to their work processes.

3. Long-Term Strategic Planning

3.1 Continue Future Planning: The implemented policy will provide the Township with a stable benefit and valuable efficiency gain. Moreover, one of this policy's key benefits is that it does not exclude other alternatives, as well as borrowing from nudges evaluated in other policy areas and testing them in code enforcement.

3.2 Utilize Agile Strategic Management in Policy Planning: Upper Darby would be well served integrating approaches in agile strategic management. Agile strategic management principles will position Upper Darby to continuously pilot programs, measure successes, and integrate successful approaches into the core services offered to constituents (Starsia, 2022).

XIII. Conclusion:

By 2045, the majority of the US population will be non-white (Frey, 2018). More American communities will look like the Upper Darby of 2024 than the Upper Darby of 1984. Regardless of future homeownership trends, great housing policy is not possible without good tenant policy.

Tenants have seldom been the target of policies to improve housing quality. Most tenant policy has centered around programs to incentivize new homeownership. While such policies are merited, quality-of-life supports for long-term tenants are ripe for policy innovation. Although some tenants want to become homeowners, not all do or will. The desire or ability to own a home should not shape one's access to good, effective, and innovative public policy.

As long as America chooses a “many communities” approach to governance, local leaders will continue to drive housing policy. Upper Darby Township has great potential to be a model of excellence for the scores of communities that will undoubtedly experience similar challenges.

Upper Darby Township can lay the foundations for other localities to leverage rental reforms to construct safer communities and ensure every resident has a safe, decent place to live.

Appendix A: Benefit-Cost Analysis and Interpretation of Revisions to Federal Regulatory Guidance

As previously noted, assumptions on the discount rate were guided by the specifications detailed by the White House Office of Management & Budget in their Circular A-4 Guidance (The Office of Management and Budget, 2023). This 2023 guidance suggested major changes to the execution of Benefit-Cost Analysis. Circular A-4's recommendations included revisions in three key areas: discounting, distributional analysis, and income-based equity weights:

1. **Lower Discount Rate:** OMB revised the discount rate⁶, which is how future investments in present terms through Benefit-Cost Analysis. In this guidance, OMB recommended a 2% discount rate for projects where benefits conclude by 2079 (Office of Management and Budget, 2023).
2. **Emphasis of Distributional Analysis:** Circular A-4 emphasized the need for distributional analysis in Benefit-Cost Analysis. Effective distributional analysis can effectively quantify how equitable a policy or regulation is through measuring how costs and benefits are spread between groups. The Kaldor-Hicks Tableau can be leveraged as a tool to quantitatively measure the spread of effects for a project (Krutilla, 2005).
3. **Quantifying Income Effects:** Economists have long recognized one additional dollar to a middle-class family is more valuable than one additional dollar to a millionaire. This guidance presented a recommended income elasticity of marginal utility to guide effect measurements across income levels (Office of Management and Budget, 2023).

This analysis uses the 2% discount rate for primary calculations, consistent with the guidance in Circular A-4. All alternatives will be evaluated at additional levels for sensitivity. These measurements include a low bound (1.7%), the previous mean (3%), and an upper bound (7%) derived from three standard deviations above the twenty-year average discount rate.

The results of the Benefit-Cost analysis can be found through [this link](#). Parties looking to recreate the Monte Carlo simulations should use [this workbook](#).

• ⁶ The previous 2003 Circular recommended a 3% discount rate, while also recommending projects also be evaluated at a 7% discount rate (The White House, 2023). However, since 2003, OMB found that the real discount rate did not exceed 3% in one single quarter (The White House, 2023).

Appendix B: Empirical Strategy in Isolating Public Safety Benefits

Both property improvement programs and elevated levels of code enforcement are associated with demonstrable public safety benefits (South, et al., 2021; Tillyer et al., 2022). The following strategies were taken to assume public safety benefits for each respective alternative:

1. Both studies computed code enforcement benefits on a block or street segment basis. Based on an ArcGIS map of Upper Darby Township's Trash pickup routes, the Township has between 2,712 and 2,719 road centerlines (Upper Darby Township, 2021). The range is due to the use of four naming structures in the GIS trash collection map. As I was unable to ascertain the data mapping strategy, the upper bound (2,719 centerlines) was used for calculations.
2. Unlike the study of Philadelphia's BSRP, I did not remove city blocks without crime (about 3% of city blocks in Philadelphia) or any township access roads to provide the lowest-bound baseline estimate (South et al., 2021).
3. Specific benefits include a 25% reduction in homicides, 22% reduction in assaults, 22% reduction in burglary, 27% reduction in theft, 29% reduction in robbery, and a 29% reduction in disorderly conduct (South et al., 2021).
4. Data for crime levels was obtained from the Commonwealth of Pennsylvania's Uniform Crime Reporting database (Pennsylvania State Police, n.d.). Crime levels in Upper Darby Township have significantly varied in the last ten years. As a result, benefits were calculated using the Township's five-year-average for the following offenses: homicides (murder and manslaughter), assault (including rape, aggravated assault, and simple assault), arson, motor vehicle theft, burglary, larceny, and robbery. In the sensitivity analysis, the standard deviation over those five years was applied.
5. This BCA calculated the benefits as a reduction in risk from each crime occurring in the Township. For example, the property repair program is estimated to reduce homicides by 0.24 homicides in a fifteen-year period. The value of the homicide benefit can be best interpreted as Upper Darby's willingness to pay to reduce the risk of one homicide in a fifteen year period by 24%.
6. South & colleagues' (2021) study of the BSRP in Philadelphia found that the crime benefits of each property repair held constant for 29 quarters (5.25 years) of their analysis. This project assumes that the public safety benefits of a home repair will sunset after ten years.
7. The formula to calculate the benefits for the property repair program is as follows:

$$crime_block = avg_yearly_crimes / total_centerlines$$

$$crime_reduction = repairs * crime_block * (1 - riskreduction)$$

$$safety_benefit_yr = crime_reduction * socialcost$$

8. For Alternatives Two and Three (Increased Code Enforcement and Nudge Interventions), some alterations were made to this formula. Benefits are achieved through an increase in code enforcement *volume* or *efficiency* rather than properties repaired.
9. Tillyer & colleagues (2022) measured public safety risk reductions from the act to increase code enforcement activity by one percent from a baseline. This study evaluated the baseline level of citations per street segment in Philadelphia. However, the level of baseline code enforcement activity in Philadelphia is lower than that of Upper Darby Township. A 2021 estimate found that only 7% of Philadelphia's rental units are

inspected in a given year, compared to Upper Darby's estimate of 33% of units inspected (Howell & Black, 2021). As a result, Upper Darby should be expected to have a higher baseline level of citations.

10. Just as total crime varies, the amount of rental properties per block also varies. To provide a low-bound estimate this analysis assumes an equal growth in code enforcement activity per street segment.
11. The benefit of increased code enforcement is then calculated using the following equations:

$$crime_block = avg_yearly_crimes / total_centerlines$$

$$crime_reduction = crime_block * (pct_enforcement_jump * 100) * crime_reduction_lpct * (Philadelphia_enforcement_frequency / UpperDarby_newenforcement_frequency)$$

$$Crime_benefit = crime_reduction * socialcost$$

12. The nudge benefit requires additional calculations to estimate increases in code enforcement activity. First, it is assumed that successful nudges to past offenders will only impact the first instance of compliance. As one-third of rental properties are expected to be inspected annually and three-quarters are assumed to have past violations, it is assumed the nudges will impact one-sixth of the Township's rental housing stock. Then, the nudge success total will be used to find properties newly compliant on the first inspection due to the nudges.

$$Total_Yr_Inspections = FirstCompliance_i + SecondCompliance_i + ThirdCompliance_i$$

$$Property_Nudged = pct_pastcitation * Total_Yr_Inspections$$

$$NudgeSuccess = Property_Nudged * nudge_compliance_rate$$

$$Pct_Enforcement_Jump = NudgeSuccess / Total_Yr_Inspections$$

13. Now, the same formula for the crime benefit can be applied to calculate the benefit from the reduction in risks to public safety thanks to more *efficient* code enforcement activity.

Appendix C: Empirical Strategy in Isolating Health Benefits

Older housing is strongly associated with elevated levels of pulmonary illness (U.S. Census Bureau, 2015). To compute health benefits, each alternative was tested for how it could reduce rates of three common pulmonary ailments: allergic rhinitis (AR) among adults, chronic bronchitis among adults, and new asthma cases among children.

To compute the benefits to public health, this work leveraged the following empirical strategy:

1. The study relied on studies that provided the rate of asthma for children in rental housing units and the prevalence of two common pulmonary illnesses – allergic rhinitis (AR) and chronic bronchitis – among adults (Ganesh, et al., 2017; Muddari, 2016; Weycker et al., 2017). For example, 0.14% of American adults are infected with chronic bronchitis in any given year (Weycker et al., 2017). Disease prevalence in the United States for each illness is multiplied by Upper Darby’s population to compute the variable listed as *prevalence_i* below. As Upper Darby’s housing age should contribute to higher-than-expected levels of pulmonary illness, these estimates should be considered low-bound findings.
2. Research has indicated that each form of pulmonary illness evaluated brings significant social costs. In addition to direct medical costs, each case of illness is found to bring indirect costs that span from lost sick days, lost wages, decreased worker productivity, and increased childcare needs (Muddari, 2016; Weycker et al., 2005). The lifetime cost of an asthma diagnosis – while discounted at a 3% rate equates to \$50,992.89 in 2023 dollars (Belova, et al., 2020). Each additional incidence of AR is associated with a cost of \$824.78 (Muddari, 2016). Each additional incidence of bronchitis diagnosis is associated with a cost of \$8685.95 (Muddari, 2016).
3. The asthma benefit is calculated only for children turning five years old in Upper Darby Township. For this estimate, I took the number of children under five and divided that number by five for each year. This estimate does not assume any population growth to provide low-bound findings. Nonetheless, Upper Darby Township’s population has consistently grown in the last three decennial censuses (U.S. Census Bureau, 2000; U.S. Census Bureau, 2010; U.S. Census Bureau, 2020).
4. The AR benefit was calculated from the annual disease prevalence for adults in the study year using the cost for one case of AR (Muddari, 2016). Similarly, the Bronchitis benefit was calculated from the total number of cases of acute bronchitis in the study year (Muddari, 2016).
5. Muddari (2016) leveraged findings that provided that 35% of housing units have some level of mold or dampness.
 - a. Using data from the 2015 American Housing study, the age of Upper Darby’s rental housing stock would indicate a 13.27% higher mold prevalence than the average American community (U.S. Census Bureau, 2015).
 - b. There is not census data that shows the relationship between housing age and housing dampness. Still, we should expect the age of Upper Darby’s housing stock to yield higher-than-expected dampness levels. As a result, the multiplier computed should be considered a low-bound estimate.
 - c. To include this multiplier the following equation was used:

$$\text{Upper Darby present mold}_h (\text{Mold} + \text{Dampness}) = (\text{EVMold} * 1.1327) + \text{EV}(\text{Dampness})$$

6. Academic research found that mold and dampness – when isolated from other factors – contributed to 15% of AR cases, 14% of bronchitis cases, and 21% of asthma cases (Muddari, 2016). In the equation below, those factors are accounted for under the variable *moldcausality_i*. I included *presentmold_h* in the below equation to account for the likelihood that code inspectors would find mold or dampness.
7. To find the expected levels of pulmonary illness caused by mold and dampness in Township homes, expected disease prevalence and mold causality were also multiplied by the expectation mold or dampness would be presently found in a household during a code inspection. The following equation was used to estimate the expected pulmonary illness attributed to mold and dampness:

$$EV(causalillness_i) = EV(prevalence_i) * EV(moldcausality_i) * EV(presentmold_h)$$

8. A study of code enforcement practices in Boston found that 24.2% of asthma triggers were fully remediated following building code inspections (Lemire, et al., 2019). As noted above, most rental properties are inspected every three years (value of *inspected_h* is 0.333) In this study, remediation of asthma triggers will be used as proxy for triggers of other pulmonary illnesses. To calculate successful remediations at baseline, the following equation was used:

$$EV(\text{BaselineRemediations}): EV(causalillness_i) * EV(remediation_h) * EV(inspected_h)$$

9. The savings from additional inspections is computed using the following specification for the property repair alternative. As with the public safety benefit, the repair effect is calculated to sunset in ten years. The highest level of benefits will be seen in years 5-10. The remediation is calculated as 1 – 0.242. Since properties in the rental repair program must pass code inspection to receive loan payments, we are assuming full remediation with code violations.

$$EV(\text{RepairRemediation}) = \text{TotalRepairedUnits} * \text{IndividualsPerUnit} * EV(prevalence_i) * EV(moldcausality_i) * EV(presentmold_h) * EV(1 - remediation_h)$$

10. The benefits from the nudge-based alternative and increased code enforcement are steady, annual benefits. Increased compliance will be computed as a percentage increase.

$$EV(\text{IncreasedRemediation}_h) = EV(\text{BaselineRemediation}_h) * EV(\text{IncreasedCompliance}_h + 1)$$

11. The increased levels of remediation are multiplied by the social cost for each associated pulmonary illness to compute the health benefit.

Appendix D: Relevant Cost Tables

Table 5: Cost Values (without Benefits, in 2022 dollars)

Type of Cost	Specific Cost	Valuation	Source
Administrative	Social Service Program Manager	\$84,520 at 100% FTE	BLS, 2022
Administrative	Social Services Program Coordinator	\$52,900 at 100% FTE	BLS, 2022
Administrative	Code Enforcement Inspector	\$71,800 at 100% FTE	BLS, 2022
Administrative	Code Enforcement Inspector	\$34.53 per hour	BLS, 2022
Administrative	Accountant	\$87,000 at 100% FTE	BLS, 2022
Administrative	Office Administrator	\$41,890 at 100% FTE	BLS, 2022
Administrative	Postcard Fee	\$0.53	U.S. Postal Service, n.d.
Opportunity	Property Manager	\$32.23 per hour	BLS, 2022
Opportunity	Existing Median Rent	\$1236	U.S. Census Bureau, 2022

Table 6: Benefit Values

Type of Cost	Specific Cost	Valuation	Source
Public Safety	Murder/Manslaughter	\$8,982,907 (2008)	McCollister, et al., 2010
Public Safety	Assault	\$107,020 (2008)	McCollister, et al., 2010
Public Safety	Robbery	\$42,310 (2008)	McCollister, et al., 2010
Public Safety	Larceny	\$3,512 (2008)	McCollister, et al., 2010
Public Safety	Burglary	\$6,462 (2008)	McCollister, et al., 2010
Public Health	Allergic Rhinitis	\$640.71 (2014)	Mudarri, 2016

Public Health	Acute Bronchitis	\$6,747 (2014)	Mudarri, 2016
Public Health	Lifetime Asthma	\$36,500 (2010)	Belova, et al., 2020
Administrative	Value of First Compliance	\$402 (2019)	Linos, et al., 2019

Appendix E: Philadelphia Rental Improvement Fund Regulations:

Philadelphia includes several regulations on their Rental Improvement Fund (RIF) program to mitigate risks.

- Active rental license and property insurance.
- Landlords can own no more than 15 properties inside *and* outside the City of Philadelphia.
- While RIF funds can be used to remediate a code violation, the property must be compliant upon completion of the repair.
- The property must *already* be rented at 60% of the Area Median Income (AMI).
- The landlord must provide a current tenant with 3 year good-cause eviction protection.
- The landlord caps rent increases at 3% per year for the duration of the loan to maintain affordability of the unit.
- Landlords who renege on affordability conditions must repay the loan at 4% interest.
- Landlords are responsible for identifying multiple licensed contractors to perform the work at the time of application.
- A multi-part loan draw schedule predicated on the property passing inspections.
- Philadelphia also builds a 20% contingency in each loan to mitigate risk.

The City notably has opted to keep this program in-house rather than contract with an external service provider (e.g. Habitat for Humanity). Although the City is hopeful these regulations limit risk exposure, the program is still in its infancy. At this point, a full analysis of this program's regulatory posture is not possible.

Appendix F: Administrative Cost Calculations for Home Repair Program

The following categories comprised Upper Darby's Administrative Costs for the implementation of a home repair program. All data references the mean prevailing wage for the Bureau of Labor Statistics.

Code Enforcement Cost (Township Administrative): Properties selected will require a pre-inspection, interim inspection, and final inspection. Each property inspection is calculated as one hour of a code inspector's time. Due to requirements with the loans, each property will be inspected annually after repairs are made. As properties are scheduled for three-year inspection intervals, this cost will be applied with a two-thirds ratio. This will continue until the ten-year duration of the loan expires. The cost of added code enforcement is computed using the area hourly prevailing wage for a Building Inspector. (Bureau of Labor Statistics, n.d.)

Program Management Cost (Administrative): I estimate the Program Management cost at 50% FTE of a program manager and 25% FTE of a senior manager in Years 0-5. In years 6-15, provided the program sunsets I estimate the program cost at 10% FTE of one program manager and 5% FTE of one senior manager. The cost of the Program Manager is computed using the area mean prevailing wage for a Community & Social Services Specialist (Bureau of Labor Statistics, n.d.). The cost of the Senior Manager is computed using the area mean prevailing wage for a Social and Community Service Manager (Bureau of Labor Statistics, n.d.).

Finance Cost (Administration): The Township's Finance Department will be needed to manage the draw schedules for the loan and potential repayment. I estimate this cost at 5% FTE of one Township accountant in Years 1-15 (Bureau of Labor Statistics, n.d.). This was computed using the mean area prevailing wage of Accounts and Auditors.

Permitting Management: All selected properties will also require permits for all work before the first loan draw. The review of permits will require the work of an L&I Administrator. I estimate this time cost at 10% FTE of one Office Administrator, estimated using the area mean prevailing wage for Office and Administrative Support Worker (Bureau of Labor Statistics, n.d.).

Appendix G: Strategy in Sensitivity Calculations & Simulations

1. Most of the studies used in the primary calculations provided standard deviations for their estimates. In the sensitivity analysis, these standard deviations were applied to each variable. Unless stated, it is assumed that each outcome is normally distributed.
 - a. Specifically, all public safety risk reductions, the value of the asthma risk reduction, and compliance with the nudge intervention were distributed in accordance with the referenced publications.
 - i. As the asthma risk reduction was calculated using a three percent discount rate and the primary calculations are at a 2% discount rate, a minimum outcome 1.5 standard deviations below the mean was assumed.
 - b. Using ACS error rates, a uniform distribution was applied to the total children in the Township under five years old and the total children in the Township living in rental households. For these outcomes, a uniform distribution was used.
 - c. The author also added several additional specifications to induce more variation. A two percent standard deviation was added to the asthma rate, a five percent standard deviation was added to the mold/dampness prevalence rate, and a 1:1 probability measure for rent increases (five-year average versus past-year growth) was added to the model.
 - d. In the study by McCollister & colleagues (2010), the authors noted a range of values provided for the social cost of crime. While the costs McCollister & colleagues measured were more inclusive, they generally represented mid-to-high estimates for the social cost of the crimes studied in their synthesis paper. To ensure this analysis is robust to lower valued risk reductions, a 10% probability will be assigned to the low-bound estimates of other studies referenced (McCollister, et al., 2010).
2. Additional points of variation were baked into each alternative to account for worst-case scenarios.
 - a. For the repair program, it was assumed that in a given year, there is a 10% that each individual project will fail.
 - i. A “failure” is considered a home where the repair project is unsalvageable by the mid-point inspection. At this point, the Township would have disbursed 30% of the loan value.
 - ii. If a project fails, the Township will still aim to complete the same number of projects. The cost of the loan failure will simply be an additional cost on top of loan expenditures.
 - iii. Failed projects will also yield a time cost of 5% FTE for the Program Manager, 5% for the Senior Program Manager, and 1% for Township finance staff.
 - b. For the code enforcement program, it was assumed that new code enforcement hires would cover as many properties as existing staff. These new hires may be more or less productive than existing employees. A normal distribution of 40 properties was applied to the total number of properties inspected.
3. In the primary calculations, the public safety and public health benefits were calculated as risk reductions. When simulated, any outcomes with a value under 1 *and* the remainder of any coefficient over 1 is calculated as a probability that Upper Darby Township will receive the benefit.
 - a. For example, the code enforcement program correlates to a risk reduction in homicides of 0.045 homicides per year. In this analysis, each year was given a

- 4.5% chance that the program would prevent a homicide to calculate the value of reducing the Social Cost of Crime.
- b. If the reduction in robberies was 1.43 a year, the effect would assume a stable one robbery benefit with a 43% likelihood of an additional robbery prevented.
4. Crime in Upper Darby Township varies from year to year. As a result, I calculated the standard deviation of the five-year average used in the primary calculations.
 - a. To avoid calculation errors, the minimum amount of crime was set at 0.
Otherwise, the crime rates followed a normal distribution.
 5. The asthma benefit was computed with a normal distribution within the 95% confidence interval provided (Belova et al., 2020).
 6. Compliance with code enforcement was also simulated across a normal distribution borrowing from Linos & colleagues (2019).
 7. Some values did not have readily accessible standard deviations, including the values of the bronchitis and AR benefits and the efficacy of the asthma trigger reduction.
 8. Outcomes were simulated 10,000 times at each discount rate of interest (2%, 1.7%, 3%, and 7%). For each simulation, the mean, median, minimum, maximum, and percentage likelihood of a positive NPV were computed.

Appendix H: Postcard Intervention from Linos & colleagues (2017)

Dear Property Owner,

I'm writing because your property located at **<locationdesc>** had code violations in the past.

Inspectors will be monitoring your neighborhood, but you can avoid potential violations by taking steps now.

Prepare in advance to avoid fines and multiple inspections! On the back, you will find a list of potential violations to watch out for and tips on how to maintain your property so that it's up to code.

Give me a call at (423) 643-7325 if you have any questions!

Jennifer B.
Neighborhood Services
City of Chattanooga



<owner_name>
<mailingaddress>
<mailingcity>, <mailingstate> <mail>

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