# THAT'S RAD? NUANCE, COMPLEXITY, AND THE FUTURE OF US PUBLIC HOUSING

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# Abstract

Public housing has always been a battleground in the fight between the public and private sectors (Vale & Freemark, 2019). At the same time, the role and importance of Public Housing cannot be understated. One interviewee mentioned, “if a resident is struggling to stay in our housing, what chance will they have anywhere else?” Nationally, the stock of public housing units has continued to age and deteriorate, leading to unhealthy living conditions for its residents. The Rental Assistance Demonstration (RAD) program addresses these capital needs, but this is not the first attempt to improve living conditions. Public housing residents and housing advocates who remember the displacement caused by HOPE VI are rightfully skeptical of relying on the private sector “fix” public housing. Therefore, this thesis aims to answer an urgent question: what are the critical financial, physical, social, and political determinants that Public Housing Authorities make during RAD conversion? Using both decision tree algorithms and semi-structured interviews, this thesis seeks to understand how these conversions occur, which can inform the analysis of tenant outcomes. For example, 45% of conversions do not rely on debt or tax credit financing, and 13% include a transfer of assistance from one building to another. This thesis concludes that RAD is neither the privatization boogeyman nor the savior of public housing. Further analysis of RAD must therefore provide more nuance and complexity to ascertain the strengths and weaknesses of a program that provided the most funding to public housing in a generation.

# Acknowledgements

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Finally, I would like to thank my family, both with us and those who are no longer. My family has remained my strongest supporter, and I would not have made it through this without their help. Special shoutout to my grandfather Harold Roberts, who instilled an insatiable curiosity in me. I would not be the woman I am today without your guidance, and I miss you every day.

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# Introduction

Enacted in November 2011 for FY2012, the Rental Assistance Demonstration (RAD) program will turn ten years old in 2022. In the language of the US Department of Housing and Urban Development (HUD), the federal agency authorized by Congress that developed and administered the program, RAD "allows public housing authorities (PHAs) to leverage private debt and equity to reinvest in the public housing stock" by converting units from Section 9 operating and capital funding to section 8 lump sum funding (RAD Fact Sheet). In doing so, PHAs may form public-private partnerships (PPPs) with private developers, and property managers. Nationally, the stock of public housing units has continued to age and deteriorate, leading to unhealthy living conditions for its residents, and Congress has, since the 1970's continued to underfund the capital requirements needed to bring the housing stock back into good repair (Vale and Freemark 2019). The RAD program is meant to address this funding need. Initially, Congress capped the total conversions to 60,000 units of the over one million public housing units nationally (Stout et al. 2019). However, due to such high demand for the program, Congress increased the unit cap every year, currently at 450,000. As a result, about 110,000 units have been converted (Hayes & Gerken 2020). This implies there are many conversions to come, and therefore it is crucial for PHAs to have a complete sense of how these conversions happen.

This thesis aims to answer an urgent question: what are the critical financial, physical, social, and political determinants Public Housing Authorities make during RAD conversion? The initial hypothesis is that the capital needs and operating costs of individual developments have an outsized role in the ownership structure of the PPPs; [large ones are assumed to be more needy and also have a more capable staff to bargain]. Still, the political geography of the area and the community of residents likely play a role as well as more republican leading municipalities may

privatize more. Generally, the initial hypothesis is that PHAs with smaller capital needs requirements and lower operating costs are in a stronger position when negotiating with ownership structures, which could result in the PHA completing the development themselves, continue management, or retain ownership of the buildings. On the flip side, buildings with high operating costs are more likely to require a higher level of private ownership to make sense for the private sector.

The results of this thesis are helpful to planners, public officials, and residents for several reasons. First, there has been little analysis of the RAD program and what the resulting ownership structures mean for the long-term success of public housing. More investigation can clear up accusations that privatization will lead to more evictions or that additional funding will only exacerbate chronically mismanaged PHAs (Kolodny, 1985). In addition, relatively little is known about the interaction between RAD and PHAs outside of New York City. Given its size, RAD will disproportionately impact NYCHA, and because of that, it has taken most of the attention. While NYCHA has closed on the most significant number of units compared to other PHAs, they have only been part of seven transactions.

In contrast, there have been 1,456 total transactions nationally, with another 542 in the pipeline (RAD Resource Desk). There are likely lessons from other PHAs missing from the discussion, and this thesis will provide a platform for this discussion. Finally, the power dynamics and their applications in forming PPPs are of most interest to planners and policy officials, and RAD has sparked considerable debate over the role of the private sector in public housing, making this thesis both timely and important.

# Chapter 2: Background

RAD is both a product of and a response to federal housing policy of the 20th and early 21st centuries that generated public housing, turned away from public housing, systematically underfunded maintenance, and, more recently, identified private finance partnerships forward. This background will lay the foundation for how HUD and policy experts conceptualized RAD and provide context for the many criticisms of RAD. While the history of federal housing policy is the subject of entire books, this chapter will highlight those that are most applicable to the debate surrounding RAD: the arrangements for public and private sector involvement since the 1930s and the little-understood yet wide variation across PHAs in implementation. The chapter concludes with a detailed description of the current RAD program.

## Public and Private Responsibilities in Public Housing, 1930-2012

The public and private sectors are both always involved to varying degrees complicating the narrative of continued privatization. RAD's history in many ways begins with the 1937 US Housing Act, a new deal-era policy that brought the federal government in housing production in a fundamentally new direction and established Public Housing Authorities. From there, HUD and the affordable housing community have experienced the shifting roles of the public and private sectors with the establishment of Section 8 vouchers (now called Housing Choice Vouchers) in the 1970s, the private incentives of the Low Income Housing Tax Credit program of the 1980s, and the public housing revitalization attempts of HOPE VI in the 1990s.

In the United States, the public-private debate has always characterized the debate around is outright unhealthy government-subsidized housing. Before Franklin Delano Roosevelt, the

federal government was largely absent from the housing market. Still, the National Housing Act of 1934, which created the Federal Housing Agency, and the U.S. Housing Act of 1937, which provided the framework for Public Housing, brought the federal government into housing in a substantive way (National Low Income Housing Coalition, 2021). Before 1937, the federal government also delivered housing through the Public Works Administration. Still, the pushback from the private sector led to a Supreme Court decision curtailing the ability of the federal government to use eminent domain. It led to housing authorities, who are given power by the individual states, not the federal government (National Low Income Housing Coalition, 2021). Further pushback from the private sector also led to income restrictions on who was eligible for public housing.

In 1974, Congress began the Section 8 program, consisting of project-based rental assistance (PRBA) and vouchers to address demand-side need housing. The PRBA provided a funding mechanism to subsidize the private sector to develop below-market units. At the same time, the Section 8 vouchers give qualifying individuals a subsidy to go out and find housing in the private housing market and make up the difference between 30% of their income and market rent.

However, the program has not been without controversy; in the 1980s, opponents argued this program became too costly, and inaccurate and offensive portrayals of the program's beneficiaries led to several changes, including a halt on the new PBRA (Vale & Freemark 2019). The voucher program is estimated to help around 2.3 million families, while the PBRA is estimated to currently help 1.2 million (National Low Income Housing Coalition, 2021). The federal government's role in housing delivery shifted the 1986 tax code to create the Low Income Housing Tax Credit (LIHTC) program. The LIHTC program provides "as-of-right" 4% and

competitive 9% tax credits to stimulate private sector development of income-restricted affordable housing. LIHTC has been the most successful housing program in U.S. history from the number of housing units delivered. Since its inception, the program has created over 3 million units (Stamm et al., 2020). In these decades, public housing increasingly fell into low investment and disrepair (Vale & Freemark, 2019).

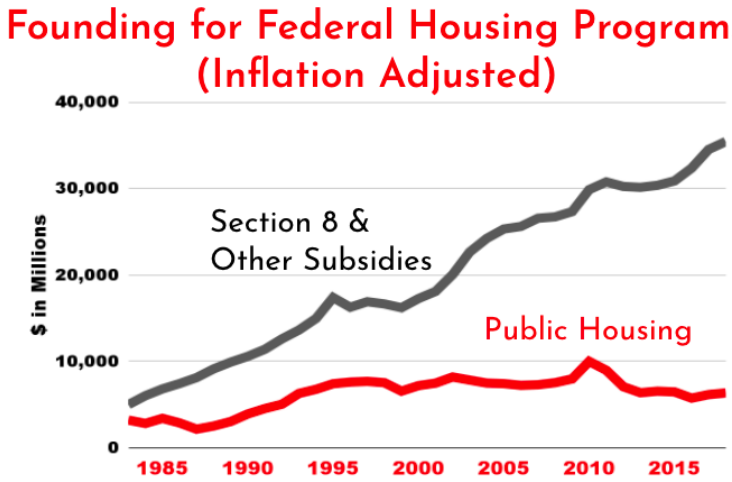



*Figure 1 - Federal Funding for housing programs 1980- 2020*

Additionally, HOPE VI was a clinton era program that has largely be derided for the excessive displacement of residents (Popkin et al. 2010). While at a similar time the Move-to-Work program tried to help improve the management of public housing (Levy & Edmonds 2020).

Finally, the Preservation, Enhancement and Transformation of Rental Assistance Act (PETRA) initiative was a short-lived precursor to RAD and never made it through congress, so program evaluations are impossible. Still, it is interesting to look at the concerns posed by advocates, academics, and congress. The critical difference between PETRA and RAD is that the latter is a voluntary program.

In 2012, the Rental Assistance Demonstration (RAD) program allowed Public Housing Authorities (PHAs) to form Public-Private-Partnerships (PPP) with private developers to utilize programs like LIHTC to access funding for much-needed capital improvements. The program shifts public housing to Section 8 housing through PRBA or project-based vouchers (PBVs). While the details of each PPP are project-specific, the delivery of these improvements comes from private developers and contractors, and often the management will shift to a private management company (RAD Fact Sheet, HUD, 2020). The PHA retains some ownership in the project, either outright or through a land lease, and administers the rental assistance programs. There has been concern among residents about what this means for their housing stability. The units converted through the RAD program are guaranteed to remain affordable in perpetuity. Still, there is rightful skepticism given the continually changing policies of the last 75 years (Fight for NYCHA, 2020).

## Current State of Public Housing

Second, while public housing now in the United States is overwhelmingly poor condition, and funding systems are broken; these conditions vary widely across localities, with dramatically different PHAs. This section will cover the radically different living conditions between housing authorities and the health outcomes this creates. Along with the different living conditions, there is also an uneven distribution of technical sophistication among these different housing authorities, with high-level employees bouncing between PHAs without much concern for competence. This creates a dangerous situation where housing for some of the nations' most vulnerable populations has not received funding to make meaningful change, and even if there was funding, there does not seem to be the competence or impetus to create meaningful change.

**Physical Building Problems**

Most public housing buildings were built before 1990. However, as the table below shows, 42% of public housing units are at least 50 years old, and more than 20% are over 60 years old (Schwartz 2020). In addition, some of the poor physical conditions can trace their problems back to 1937 (Schwartz, 2015).

Table 6.1 Change in the public housing stock, 1949–2019

| Year | Total Units | Change from Previous Period | |
|---|---|---|---|
| | | Total | Percent |
| 1949 | 170,436 | | |
| 1959 | 422,451 | 252,015 | 147.9 |
| 1969 | 792,228 | 369,777 | 87.5 |
| 1980 | 1,192,000 | 399,772 | 50.5 |
| 1990 | 1,404,870 | 212,870 | 17.9 |
| 1994 | 1,409,455 | 4,585 | 0.3 |
| 2000 | 1,266,980 | (142,475) | −10.1 |
| 2010 | 1,173,340 | (93,640) | −7.4 |
| 2012 | 1,156,839 | (16,501) | −1.4 |
| 2015 | 1,119,864 | (36,975) | −3.2 |
| 2019 | 987,133 | (132,731) | −11.9 |
| Change | | | |
| 1949–1980 | | 1,021,564 | 599.4 |
| 1980–1994 | | 217,455 | 18.2 |
| 1994–2019 | | (422,322) | −30.0 |

*Sources*: 1949–1980, Stegman 1989; 1990–2000, U.S House of Representatives, Committee on Ways and Means 2008, Table 15–8; 2010–2019, HUD 2020a.

*Figure 2 – Total Public Housing Units by Year*

The legislation that created public housing capped the total development costs to $5,000 per unit in cities with over 500,000 people and $4,000 for the rest. In comparison, the housing developed under the PWA averaged $4,975 (Scwartz 2010). This meant new housing would have to be built to lower standards to remain below the cap. The cheaply constructed buildings of the post-war era directly relate to the current problems facing PHA buildings today.

A 2010 report prepared for HUD estimated the total capital needs were approximately $25.6 billion, or $23,365 per unit (Finkel et al. 2010). Additionally, HUD estimated the average annual accrual needs at $3.4, or $3,155 per unit. The conditions per unit do vary across PHS of

different sizes. Smaller PHAs were estimated to have between $11,002 and $19,501 per unit of existing needs, whereas the largest PHA, those with 6,600+ units, was estimated to have $21,464 and $35,642 of existing capital needs per unit (Finkel et al. 2010; 19). The study also looked at the key drivers of capital needs. 39% of all needs were dwelling unit needs such as kitchens, bathrooms, and interior doors. Building exteriors such as windows, roofs, and doors contributed 34%. Site systems such as sanitary, gas, and water line round out the top three with 19% of the estimated needs.

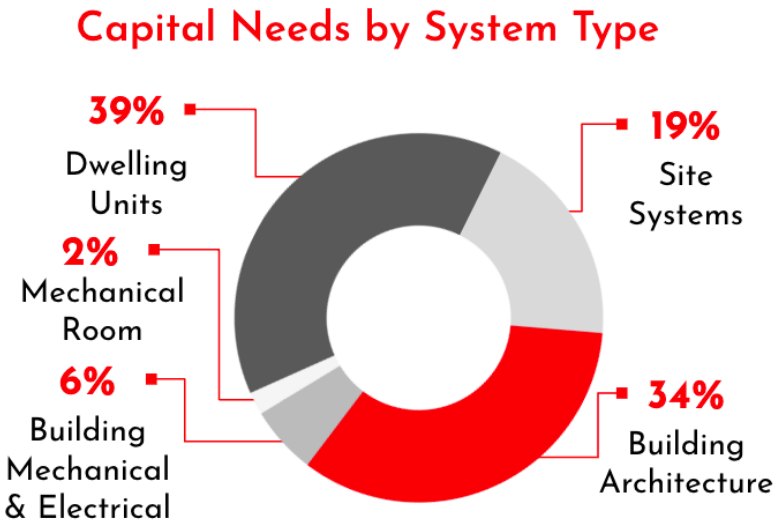



*Figure 3 – Public Housing Capital Needs by Building System*

The 2010 capital needs report for HUD also compared the current capital needs across the four census regions: Northeast, South, Midwest, and West. Capital needs are highest in the West, at $39,221 per unit. The capital needs in the Midwest were lowest at $9,507 per unit, which is likely due to the large proportion of senior housing, which has lower repair needs. The northeast averaged $22,418 per unit. Without New York City and Puerto Rico (included in the northeast because it is not assigned a region), the average capital needs to drop to $17,600 per unit. Finally, the South averaged $16,268 per unit.

| Inspection-based Estimates of Capital Needs by Census Region | | | | | |
|---|---|---|---|---|---|
| **Census Region** | **All** | **Northeast** | **Midwest** | **South** | **West** |
| **Sample Properties** | | | | | |
| Overall | 548 | 239 | 91 | 178 | 40 |
| Family | 400 | 196 | 41 | 134 | 29 |
| Elderly | 148 | 43 | 50 | 44 | 11 |
| **Inspection Universe Units** | 1,085,407 | 403,265 | 208,666 | 389,508 | 83,968 |
| **Inspection-based Estimate of Existing Need Per Unit** | | | | | |
| **Means** | | | | | |
| Overall | $19,029 | $22,418 | $9,507 | $16,268 | $39,221 |
| 95% Confidence Interval | $17,520 to $20,537 | $20,094 to $24,741 | $6,910 to $12,103 | $14,159 to $18,377 | $32,112 to $46,331 |
| Family | $22,190 | $25,433 | $11,792 | $17,774 | $44,421 |
| Elderly | $11,646 | $12,671 | $7,284 | $11,961 | $25,801 |
| Median | $15,374 | $19,553 | $5,131 | $12,634 | $35,273 |
| 25th percentile | $5,248 | $7,734 | $3,148 | $5,502 | $24,136 |
| 75th percentile | $28,570 | $34,621 | $14,641 | $23,786 | $53,248 |
| **Total across All Units** | $20,653,779,752 | $9,040,272,416 | $1,983,700,043 | $6,336,477,890 | $3,293,329,404 |
| **Average Annual Accrual Years 1-20 Per Unit** | | | | | |
| **Means** | | | | | |
| Overall | $3,155 | $2,987 | $3,159 | $3,265 | $3,437 |
| 95% Confidence Interval | $3,060 to $3250 | $2,858 to $3116 | $2,926 to $3,392 | $3,104 to $3,426 | $2,984 to $3,890 |
| Family | $3,415 | $3,133 | $3,968 | $3,426 | $3,865 |
| Elderly | $2,547 | $2,517 | $2,373 | $2,807 | $2,331 |
| Median | $2,995 | $2,840 | $3,001 | $3,141 | $3,191 |
| 25th percentile | $2,443 | $2,371 | $2,465 | $2,502 | $2,697 |
| 75th percentile | $3,790 | $3,515 | $3,675 | $3,965 | $4,303 |
| **Total across All Units** | $3,424,286,269 | $1,204,616,900 | $659,192,145 | $1,271,886,136 | $288,591,087 |

*Source: HUD 2010, Capital Needs in the Public Housing Program*

*Figure 4 – Capital Needs by Region*

Overall, the capital needs backlog decreased between 1998 and 2010. This is partly due to a 9% reduction in the number of public housing units due to HOPE VI demolition. Many of the worst-performing buildings were slated for demolition and therefore had an outside role in decreasing the average backlog (Finkel et. Al 2010, 59). Regardless of the decrease, the report made it clear that Public Housing desperately needed an injection of funding to address its capital needs. A new program would be introduced two years later targeting this very need: RAD.

**Management Problems**

Following the changing role of the federal government in housing, this section will focus on the physical state of public housing buildings. It is essential to understand what kind of housing authorities exist, how they are run, and the types of assets they control to evaluate

whether RAD addresses public housing authorities' critical problems. The section will start with public housing authorities and then focus on the physical needs of their assets.

Altogether, housing authorities peaked at 1.4 million units in 1994 before HOPE VI facilitated a net loss of 95,57 public housing units (Schwartz, 2020). New development only replaced 57% of all public housing units demolished under HOPE VI. Many of those redevelopments involve Low Income Housing Tax Credits and do not provide the same level of subsidies to provide housing for very low-income households. Additionally, 13% of redeveloped units were market rate and even homeownership (Schwartz 2010). The different types of housing subsidies introduced and expanded the range of residents' incomes. HOPE VI also transformed the management of PHA, and many of the projects shifted to private management companies. Before HOPE VI, many PHAs did not use separate site-specific operating statements to track performance in a centralized manner. The program also requires PHAs to create a "Transformation Plan" that develops a strategy for improving distressed public housing and other subsidized housing in the surrounding neighborhood.

Many see these changes as necessary to address the chronic mismanagement of many PHAs and even corruption. Richard Baron, a developer with McCormack Baron Salazar heavily involved with the genesis of HOPE VI, wrote, "One could argue that the difficulties of traditional public housing were caused largely by a failure of management" (2009). PHA mismanagement is not a new concept, and HUD began reform initiatives as early as the 1960s (Goetz 2013). The operating costs are often much higher than market-rate housing, which is often cited due to overstaffing and centralized, hierarchical management structures (Schwartz, 2010). As part of the HOPE VI legislation, Congress began underfunding operating subsidies,

which did little to address the operating costs and often led to "sizable capital budget deficits'' (Schwartz, 2010).

Mismanagement got so bad in cities like Washington D.C, Newark, New Jersey, and Miami, Florida, that the federal government had to step in and put the PHAs into receivership. The receivership process involves "either a contractor or a HUD employee to take over the housing authority's management" (GAO 2003). Since 1985, there have been 19 PHAs that have gone into administrative receivership. On the other hand, Judicial receivership occurs due to lawsuits filed by residents for poor living conditions. Both forms of receivership operate similarly and involve a complete takeover of operations. Still, the government accountability office found that "court-appointed receivers are more insulated from local politics and better able to make necessary changes at the housing authority" (2003).

## Housing Authorities and Receivership

| Public Housing Authority | Units | % of Total PHA Units |
|---|---|---|
| Chicago Housing Authority | 21,924 | 1.88% |
| Philadelphia Housing Authority | 16,636 | 1.42% |
| Boston Housing Authority* | 10,952 | 0.94% |
| Miami-Dade Housing Agency | 9,221 | 0.79% |
| D.C Housing Authority* | 8,184 | 0.70% |
| Other PHAs in Receivership | 30,430 | 2.60% |
| New York City Housing Authority** | 178,402 | 15.27% |
| Total Units in Receivership | 275,749 | 23.60% |

* Judicial Receivership
** NYCHA has not officially been put in receivership

*Figure 5 – Top PHAs that have been in receivership*

These examples of receivership lead to another issue facing PHA management, corruption. Many of the top positions at PHAs are politically appointed and not based on

experience and education (Schwartz 2020). MORE TO ADD FROM - Post-war Housing in Trouble Chapter: Management Problems in US Housing and Lessons from abroad.

## Overview of Rental Assistance Demonstration (RAD)

the RAD program, the 2012 law that allows PHAs to utilize public and private debt and equity to address the astronomically high capital needs requirements. This section provides an overview of RAD's goals and an overview of the steps involved in a RAD conversion. Ultimately, the program shifts ongoing funding from the traditional congressional appropriations model (see next section) to project-based Section 8 vouchers, which provide one lump sum that is often higher than the previous model. Additionally, PHAs can shift ownership and management to a non-profit entity, a for-profit entity, or all three to utilize different funding sources. The program further blends the public-private line, and this is exactly where this thesis sits. RAD appears to be the future of public housing in the United States. Therefore, it should be understood as much as possible, not just because it creates concerns about privatizing a public asset but because it might help create safer healthier housing.

The RAD program began as a demonstration program with a cap of 60,000 units. A demonstration program means that the PHA must provide evidence of conversion from traditional public housing funding to project-based vouchers or project-based rental assistance. Additionally, there are two kinds of RAD programs: "RAD Public Housing" and "RAD 2," which provide private multifamily developers with subsidized housing through "Rent Supplement (Rent Supp), RAP, Section 8 Mod Rehab, McKinney Vento Single Room Occupancy, and Section 202 Project Rental Assistance Contracts (PRAC) to project-based

Section 8 Housing Assistance Payment (HAP) contracts" (Evaluation of RAD 2019). This research focuses exclusively on RAD Public Housing, and will therefore not look at RAD 2 data.

The first step a PHA must take to start a RAD conversion is to develop plans and identify their individual conversion goals. This step includes identifying buildings. Sometimes, the PHA will choose to convert the entire portfolio. This conversion can also occur in different phases, so it is important to understand each decision's implications thoroughly. For example, the difference between using project-based vouchers, which the PHA administers, and project-based rental assistance, which is administered through the HUD field office, will change the operational needs of the PHA. Finally, the PHA needs to understand the capital needs of the buildings it plans to convert, address them, and hold two public meetings with residents to explain the process and how the change will affect them. Once this step is completed, the PHA can submit their RAD Application.

The application process allows the PHA to continue refining its goals through ongoing discussions with HUD, Residents, and other stakeholders. To streamline the process, the Capital Needs Assessment is no longer required for the application, and the initial financing plan is no longer required at this time either. The RAD rents are also decided on at this time.

There have been several changes to HUD's guidelines since its inception. Most notably, the cap on conversions has increased steadily every year. The 60,000 unit cap was raised to 185,000 in December 2014, 225,000 units in May 2017, and 455,000 units in 2018. Additionally,

Section 18 blends - I will add.

# Chapter 3: Literature Review

This chapter will provide an overview of the RAD program's current literature. The first section will discuss the literature surrounding RAD, and the second section will take a broad look at how housing policies have been evaluated in the past. There has been a significant amount of writing putting RAD in a historical context. Academics and commentators wrote much of the literature in the program's earliest years. Even the HUD report released in 2019 was based on projects converted prior to 2014 in the program's first two years. However, that report did come out after a 2018 Government Accountability Office (GAO) report with monitoring and evaluation concerns with the RAD program. The GAO report has sparked considerable concerns about the program and led to several negative media coverage and continued concerns about the privatization of public housing. HUD has released a response to GAO's report, agreed with all recommendations, and pledged to make changes to improve monitoring and evaluation. The 2019 *Evaluation of HUD's Rental Assistance Demonstration (RAD)* does continue that discussion. Therefore, researchers need to continue focusing on how the program operates.

The RAD program has also garnered considerable focus from the academic community with various perspectives ranging from the health impacts on tenants to the programs' effect on LIHTC allocations. What appears to be missing is why and how PHAs decide to convert their units. As detailed in Chapter 2, the conversions happen in various ways, and PHA's motivations are based on their local context. Alex Schwartz suggested an area of further research would be to complement his "insight into the number and basic characteristics of RAD projects" with "more qualitative information on the criteria PHA uses to decide which properties to submit for RAD conversion." (2017, 802). After this comment was released, HUD's report does focus on conducting interviews with PHA officials; however, it does admit to only being focused on the

"early adopters" (2019, 4). Finally, HUD's Policy Development and Research Office issued an August 2021 edition of Cityscape that featured five RAD articles. The report concluded, "future research to continue to study how specific housing authorities implement RAD conversions, what goals they have for the converted properties, how different RAD conversion strategies and goals impact current residents, and how physical and financial improvements will impact the housing authorities' ability to house future residents" (2021). Again, there is still work needed on this topic. This thesis responds to this call, and adds to this line of research to better understand the motivations of PHAs.

The second section of this chapter will focus on evaluations of preceding federal policies, namely, HOPE VI, Move-to-Opportunity, and Move-to-Work. As the last two major federal programs attempted to improve the state of Public Housing, there are many lessons learned. Furthermore, these programs have impacted PHA's strategies using RAD based on utilizing the previous programs. The section will provide a different perspective from the previous chapter's background by focusing more on how researchers evaluated these programs rather than the programs' structure. These evaluations will provide a valuable understanding of how researchers assess the success and failures of programs meant to improve public housing. Together, the literature review of RAD and the previous programs help to focus the succeeding chapters, particularly chapter 4's methodology and chapter 6's discussion.

## Evaluations of RAD

This chapter will provide an overview of the RAD program's current literature. The first section will discuss the literature surrounding RAD, and the second section will take a broad look at how housing policies have been evaluated in the past. There has been a significant amount of writing

putting RAD in a historical context. Academics and commentators wrote much of the literature in the program's earliest years. Even the HUD report released in 2019 was based on projects converted prior to 2014 in the program's first two years. However, that report did come out after a 2018 Government Accountability Office (GAO) report with monitoring and evaluation concerns with the RAD program. The GAO report has sparked considerable concerns about the program and led to several negative media coverage and continued concerns about the privatization of public housing. HUD has released a response to GAO's report, agreed with all recommendations, and pledged to make changes to improve monitoring and evaluation. The 2019 *Evaluation of HUD's Rental Assistance Demonstration (RAD)* does continue that discussion. Therefore, researchers need to continue focusing on how the program operates.

Much of the literature around the RAD program falls into "privatization concerns" and "outcome evaluation." The privatization literature tends to take a historical look at the role of the private sector in public housing from its inception. The outcome evaluations focus on assessing whether the RAD program is achieving its goal of bringing public housing into good repair and whether this is a successful mechanism to reach that goal. This thesis intends to sit between these two categories and address a space largely ignored: Do RAD conversions lead to privatization, and what are the critical decisions during RAD conversions? To date, scant research examines why PHAs make the decisions throughout the conversion process, and only anecdotal media reports discuss the formation of the RAD PPPs.

Within the "Privatization concern" literature, the consensus seems to be clear: public housing has never indeed been public. As Vale and Freemark write in their essay, "Privatization," in this sense, is a term of derision proffered by those who see RAD as no more than another component in the neoliberal takeover of American cities—another way to push out

the poorest to make way for private investment. This critique fits into the larger narrative that "American public housing has been on the pathway to privatization since its very inception" (Vale & Freemark 2019, Page 189).

This narrative ties in with others who have described RAD as "the slow death of public housing," as discussed in Blumgart's article (2015), with some reports have even gone as far as calling the RAD program the "genocide of poor people" (Meronek et al. 2015). When HUD first announced the program, these concerns appeared well-founded, given the evaluations of the previous housing policies mentioned in the previous section. There is rightfully distrust among public housing residents and housing advocates that HUD would have their best interest in mind when developing policies (interviewee). While these concerns are valid and extremely important (see Discussion section for elaboration), this literature seems to lack the acknowledgment that all RAD conversions occur in the same way. When it is mentioned, it seems to be an afterthought. Hanlon does admit, "RAD is often associated – and at times conflated – with privatization, but RAD conversion does not necessarily entail private-sector ownership," however, writing about the transfer of ownership in the abstract seems misleading at best (2017). In a 2016 master in planning thesis at MIT, Gabriel Silerblatt looks at two examples, Cambridge, MA and Tacoma, WA, about "All-in" PHAs that work to address the capital needs of their housing stock while retaining maximum control. There is a potential for keeping public ownership. Still, as the thesis ends, "More research on the organizational models and capacity barriers of All-In implementation for PHAs will be needed to guide the RAD program's reform and ensure optimal public stewardship and accountability over our most deeply affordable housing resource" (2016, Page 67). These case studies highlight the importance of interrogating the different conversion types to understand RAD's weaknesses better. Hanlon concludes that much of the RAD research

up 2016 "has been speculative, and independent evaluations of the program beyond those commissioned by HUD are non-existent" (2017, 632), and to some extent, that has changed in the last five years, and requires further review to understand the current research gap better.

The other line of literature focuses on the outcomes of the program. Some of these outcomes are the financial and physical condition outcomes of conversion, like in HUD's Final Report on RAD Evaluation (Stout et at. 2019). Others' focus can either be health-related, like in the case of Dubbin et al. (2018), that uses a mixed-methods approach to focus on "health burdens that public housing residents bear and the health benefits that investment in public housing renovation may bring" (Dubbin et al. 2019, Page 432). Finally, others like Aratani et al. focused on childhood development in demonstration projects (2019). While these topics do not tie in directly with the scope of this thesis, they highlight the other missing piece of literature: the lack of research about the process of conversion.

## Evaluations of Previous Housing Policies

As discussed, HOPE VI led to the demolition of a large share of public housing (See Chapter 2). Many program evaluations have focused on the impacts on the residents' health, social, and economic outcomes. Some evaluations have focused on the case study analysis of the HOPE VI projects in Louisville, KY, and Boston, MA (Hanlon, 2010, Curley, 2010). Park Duvalle in Louisville, KY, was held up as a success story (Hanlon 2010). Park Duvalle replaced 1,116 units of public housing at Cotter Homes and Lang Homes. In 1996, residents were moved out to other public housing units or given an HVC. The five-phase project took 12 years to complete, with 250 market-rate rental units, 363 public housing units, and 450 for-sale units. Additionally, 150 rental units were built off-site. The project's success comes from evidence of

improvements to the income, poverty, and employment indicators. Still, in 2010, "There remains the question of what happened to the over 400 former Cotter-Lang households who relocated without assistance" (Hanlon, 89). Despite this, the program was held up as a success story by HUD. It was even depicted misleadingly by HUD alongside another development, Algonquin Manor, as an example of the neighborhood improvements of HOPE VI.

Examples like Park Duvalle prompted research into the impacts on the original residents of HOPE VI developments. In fact, in 1999, HUD commissioned two studies, the HOPE VI Panel Study and the HOPE VI Resident Tracking Study. Popkin et al. conclude that the effects on former residents have been mixed (2004). While some are better off, there are still families experiencing hardship. The article concludes that more interim support is needed, vouchers offer residents a choice but may lead to disruptive moves, and residents with multiple complex problems appear to be the worst off (Popkin et al. 2004).

Unlike HOPE VI, Move-to-Opportunity focused solely on tenants. Additionally, participating residents were selected at random, which created a social experiment. This has prompted several research papers focusing on child development, adult outcome, and crime (Chetty et al., 2016). Earlier papers such as Sanbonmatsu et al. were conducted four to seven years from the beginning of the experiment and found no evidence of any benefits (2007). This highlights a critical problem with policy evaluations: early evaluations may provide different outcomes than research done over a longer period.

On the other hand, Move-to-work focused on the management of PHAs and the flexibility to pool funding streams. A 2004 Urban Institute report attempted to evaluate MTW, "found it difficult to assess the impacts on resident outcomes because Individual components of agencies' MTW initiatives cannot always be analytically separated or untangled. Unlike MTO,

implementation was not." (Levy & Edmonds 2020). A more recent study concluded the flexibility of MTW has allowed participating agencies to leverage new funding sources, improve properties, and create new housing options (Levy & Edmonds 2020).

These three policies provide three crucial lessons that can apply to evaluations of RAD. First, HOPE VI made it clear that resident tracking is essential, especially in demolition and new construction. Second, MTO research highlighted the importance of ongoing evaluation since short-term outcomes may be different than long-term outcomes. Finally, MTW provided some evidence that flexibility can help PHAs adapt to the residents' needs and improve housing options. Still, it can be challenging to ascertain what caused the success when many changes coincide. All three lessons apply to RAD to varying degrees. While primarily a preservation tool, RAD can be used to move residents. In addition, these conversions come with a number of changes, and the program has existed for less than ten years. Together, these lessons will impact the discussion section in Chapter 6 and play a significant role in the methodology in the following chapter.

# Chapter 4: Methodology

Altogether, the publicly available data help create a functional but incomplete picture of how RAD conversions occur. In addition, much of this data has been discussed at length in both Schwartz's 2017 analysis and HUD's 2019 evaluation. This decision tree classification expands their work and utilizes a more extensive data set. As Schwartz writes, "These data should be complemented with more qualitative information on PHA's criteria to decide which properties to submit for RAD conversion" (2017). Furthermore, while HUD's evaluation report does include some qualitative interviews, they admit, "The RAD properties examined for this study resemble the first cohort of RAD projects—the "early adopters." As such, they could differ from properties currently going through RAD conversion" (2019). Therefore, the results of this decision tree classification are just the first step in addressing these concerns and will be used as the basis for conducting qualitative interviews described in the next section.

A mixed-methods approach fit the core question of my thesis because the data analysis provides a structure of analysis and expands previous work, At the same time, the qualitative interviews provide an opportunity to more deeply understand how the PHA officials think about RAD conversions. First, to provide a baseline understanding of what kinds of conversions take place, I developed and utilized a supervised clustering decision tree and interviews with individuals experienced in RAD conversions. The first part of this section will include the variables used in the clustering analysis. To capture the heterogeneity and nuance of conversions, I conducted interviews, following an approved IRB protocol.[1] These conversions are complex,

[1] IRB Protocol Number AAAT9869

and there is no one way PHAs convert their public housing to section 8, but there are some common ways they are converted.

The clustering analysis drew on HUD's centralized data[2]; HUD's RAD resource website provides publicly available tabular data for every conversion. As of March 7, 2022, there are 2021 developments in the data set. These projects can range in status from "CHAP awarded" to the "financing plan submitted" to finally "closed." For this research, the dataset was restricted to "closed." There are two reasons for this decision. First, this ensured the project had all relevant data and people close to the project were still working with the Housing Authority. Second, the project is not too early in the process that key decisions, such as new construction or tax credits, have already been made, making these projects the most valuable to speak to at the current moment. However, there are some drawbacks to this decision. Key among them is the relative size of the data set. There are only 92 projects at this stage, representing 4% of the total projects in the database. It is important to note that there was a large share of the projects converted early on, and it would stand to reason that there were different driving factors that made PHAs convert their units in 2013-2014 than in 2021-2022. Thus the conclusion of this research may not be generalizable to all projects ever converted. However, given the current development climate, it may be more generalizable to future projects—more on this in the discussion section.

[2] In the fall of 2021, I submitted a FOIA request for XXX, but am still awaiting an answer. The data that exists – includes general inteformation about the high level structure of the conversion, but is missing important information about ownership structure, and management agreement.

# Quantitative Data Analysis

## Decision Tree Classification

A decision tree algorithm (DTA) is a simple supervised classification. It is a series of binary (yes or no) questions, which creates a flow chart-like output. The goal of the decision tree is to use a series of simple rules that will create several homogeneous groups assigned to a specific classification, called a target variable. The target variable is analogous to a dependent variable in linear regression. Still, decision trees are often used to predict events by using a training set to predict a test set. In this case, there will be no prediction per se, and the analysis will simply use the decision tree to create systematic classifications of the entire dataset of projects.

### *A Note on Dummy Variables*

The decision tree algorithm utilized in this research requires binary choices for splitting and a categorical variable for the target variable. However, some variables included in the dataset are categorical, a variable that can take the value of a limited number of possible values, or continuous, a variable that can take an unlimited number of possible values. To address this issue, categorical variables need to be converted to dummy variables. Dummy variables create a series of binary variables used to model the same information.

### *A Note on Pruning Techniques*

The decision tree in this research does not use any pruning techniques. When decision trees are used for prediction, they need to create enough separation of groups with functional interpretation but not so separated that the groups are too small, called overfitting. One technique to achieve this is a process known as pruning. There are two types of pruning: pre-pruning stops

the splitting before it has been completed, and post-pruning completes all the splits and goes back and removes the sub-optimal subtrees. However, this research is focused on classifying the entire population of RAD conversion, and not prediction, and therefore no pruning techniques are necessary. In this specific use case, overfitting is useful because it provides additional nuance.

## Description of Variables

### *PHA Size*

The first variable included in the decision tree is the PHA's size. This categorical variable has three options: Small, Medium, or Large. Small housing authorities administer fewer than 250 units and approximately 75% of all PHAs. However, they only account for less than 20% of total public housing units nationwide. On the other hand, Large PHAs, administer more than 1,250 units and account for more than 50% of all units, but only for 4% of housing authorities. Finally, medium PHAs are between 250 and 1,250 and account for 21% of PHAs and 28% of units.

| | PHAs by Size | | |
|---|---|---|---|
| Categories of size | Number of PHAs | Percentage of PHAs | % of Units |
| NYCHA | 1 | 0% | 17% |
| 1250+ Units | 124 | 4% | 38% |
| 500-1249 Units | 225 | 7% | 15% |
| 250-499 Units | 423 | 14% | 13% |
| 50-249 Units | 1541 | 50% | 16% |
| Less than 50 Units | 782 | 25% | 2% |
| **Total** | **3,096** | **100%** | **100%** |

*Figure 6 – PHAs by Size*

Dummy variables were created for binary options to be included in the decision tree algorithm. However, large PHAs account for the largest number of projects in the data set, at 678. Therefore, the large PHA dummy variable was dropped from the analysis following the explanation in the Dummy Variable Trap section above.

***Type of Conversion***

As discussed in the Overview of RAD section, conversions can occur using Project-Based Vouchers (PBVs) or Project-Based Rental Assistance (PBRA). This binary variable assigns a value of 0 for PBVs and 1 for PBRA. The majority of projects in the dataset, 912, utilized PBVs, while t 555 projects used PBRAs. This is a drastically different ratio than the 50-50 split Schwartz found, and therefore it is crucial to understand why PHAs made this decision (2017).

***Transfer of Assistance:***

There are many reasons that a public housing authority might transfer the assistance of the existing public housing. Often, these reasons are because the existing configuration is not compatible with the local housing goals. The first example would be in the case of new construction. Perhaps the current building is in such condition it does not make sense to rehabilitate. In this case, the transfer of assistance will occur if a new building is constructed and the same number of units are replacing the deteriorating public housing.

***New Construction***

The new construction variable is another binary variable with 0 for projects with no new construction and 1 for projects with new construction. This could be because the total cost of rehabilitation might be more significant than building a new building, or the management of a scattered site portfolio is more complicated than a single building—only 251 projects in the dataset utilized new construction.

***Tax Credit***

The tax credit variable is a categorical variable with four options: "no tax credits," "4% tax credits," "9% tax credits," or "both 4% and 9% tax credits." These tax credits equity options are often reported as an important tool that RAD adds to PHA's financing options, so it is interesting that 823 projects in the data set do not use any tax credits. Four hundred twenty-two projects use 4% tax credits, 217 use the competitive 9% tax credits, and only five projects take advantage of both credits. Again, categorical variables have to be converted to dummy variables to create binary options. Therefore, the algorithm will include three binary dummy variables: "4% tax credits," "9% tax credits," or "both." While the dummy variable for the largest category, "no tax credits," was dropped from the dataset.

***FHA Insured***

A common concern about RAD is the foreclosure risk created by taking on debt. One way to eliminate this risk is to obtain FHA insurance when taking out private debt. The data set includes a binary variable, which denotes a 0 for "no" and 1 for "yes." There is no requirement to apply for FHA insurance, but it is recommended to ensure the building remains in public ownership in the event of foreclosure. Only 171 projects take advantage of FHA insurance.

***RAD/Section 18 Blend***

As mentioned in section three of Chapter 4, PHA can utilize section 18, the demolition or disposition of public housing, if specific criteria are met, which results in higher contract rents. Section 18 units must be replaced one-to-one. Additionally, Small PHAs, those with less than 250 units, can dispose of 80% of their units at their discretion, though only 8 of the 69 projects in the dataset that used RAD/Section 18 blends were small PHAs. This variable is also binary, with 0 denoting no blend and one denoting that a RAD/Section 18 blend was used on the project.

***Total Financing/Converted Unit***

Finally, the feature variable for this decision tree is a categorical variable that represents the total amount of private funding per unit. This is calculated by adding the Tax Credit Amount to the Total Hard Debt used and dividing the total number of units converted. This variable needs to be a categorical variable for the algorithm to work. Therefore the data was converted into three categories, 0 no debt, one low debt, and two high debt.

## Qualitative Analysis: Interviews

**Interview Goals**

The interviews conducted had two main goals: to provide context to the clustering data analysis and share the knowledge of experienced practitioners. The first goal has been discussed at length in previous sections, but the second goal is worthy of further elaboration. With some exceptions, RAD conversions are complicated transactions with far-reaching implications. Every interviewee mentioned how much easier subsequent conversions were following a steep learning curve during their first project. While this paper cannot provide a perfectly comprehensive understanding of every complexity, it is important to share experiences so the next housing authority can better understand the costs and benefits of RAD conversions. Previous evaluations have focused on quantitative aspects of RAD, such as the percentage of projects that used 4% tax credits and other administrative data (Schwartz, 2017). These qualitative interviews provide insight into the motivations of PHAs. Data analysis is an important and valuable tool. However, in the end, there are human beings making decisions, and the more information they have, the better equipped they will be to make the right decisions for their housing authority and its tenants.

### Recruitment Methodology

After the data analysis was complete, the next step in my mixed-methods case is to complete interviews with individuals experienced in RAD conversions. While the clustering algorithm was meant to bring light to typical trends, each conversion is unique and heavily based on project-based nuances. Therefore, this mixed-methods approach is needed to add necessary context to the identified clusters. This section will provide an overview of the recruitment process and what kinds of questions they were asked. The final part of this section will conclude with some limitations to this method, including the difficulty of recruiting specific individuals.

Once the clusters were identified, recruitment began systematically to get a representative sample of experiences. This process began by reviewing housing authorities' websites to identify individuals involved in planning, development, or asset management. These individuals were contacted through email and cold calls. When contact information was not readily available on the Housing Authority website, individuals were contacted through LinkedIn by searching for the PHA and reviewing the "employees" section. This was the most fruitful since it was easy to identify individuals' tenure, which is valuable given that this is a decade-old program.

### Interview Questions

Interviews were conducted in a semi-structured manner. While there was a list of specific questions to guide the conversation, it was primarily up to the interviewee to direct how they saw fit. There is a considerable amount of the local context and institutional history. Therefore questions had to remain general enough to solicit meaningful responses but specific enough to compare responses. However, the questions surround main themes such as the property's current and capital needs requirements, funding structures and difficulties, ownership structure and private involvement, and community engagement. These interviews were conducted using a

combination of telephone calls, Zoom, and Microsoft Teams and lasted between 45 minutes and one hour. Detailed notes were kept, and some interviews were recorded with the interviewee's permission.

Not every question was relevant to all interviewees, and in these cases, the questions were rephrased to fit the context better. For example, some housing authorities have not formed partnerships with private developers, so the question, "How was the private developer and/or manager chosen?" would be irrelevant. In this case, the question was reformed to ask, "What went into the decision not to use private developers and managers?" In addition, follow-up questions were often posed as hypothetical scenarios. For example, if a project used Project-based Vouchers, a follow-up question would be posed, "in what scenario would you consider using Project-based Rental Assistance?" These follow-up questions allowed for a deeper understanding of the interviewee's decision-making process, as they helped illuminate why some options were avoided rather than focusing exclusively on the actions taken by the housing authority. Unfortunately, these interviews could not capture every detail of the process. However, they still accomplished their intended purpose.

# Chapter 5: Results

The following chapter will focus on the research results, beginning with the decision tree algorithm. This section describes the largest clusters, and what the implications mean for each RAD conversion. Surprisingly, most RAD conversion have used very little and even no debt. Furthermore, RAD transfer of assistance, which is extremely disruptive to residents, has been infrequently used, suggesting residents have not been displaced the same why they were with HOPE VI. Finally, PBV are the overwhelmingly more popular way to complete conversions.

Additionally, there is a regional-level spatial analysis in an attempt to shed light on whether certain conversion typologies are more common in various parts of the country. The goal of this analysis is not to provide an exhaustive list of different typologies, but rather to highlight the most common ways public housing authorities utilize the RAD program. Additionally, there are some clear limitations with the data used in this analysis, which will be discussed in the following chapter. Nonetheless, these results were still useful in providing a more representative qualitative interview recruitment methodology.

The third section of this chapter will discuss the important takeaways from those interviews. These semi-structured interviews were useful in providing project, and housing authority, specific nuances that would not be easily explained in the publicly available data used in the data analysis section. Anyone who has worked on a RAD conversion project has first-hand knowledge of how unique each conversion is, and this knowledge should be shared widely to assist future conversions. Just as the data analysis had limitations, there are additional limitations of these interviews, including recruiting challenges. Again, a more detailed discussion of these limitations can be found in Chapter 6. Together, this mixed-methods approach provides a new perspective on the RAD program and the key decisions during the conversion process. More

importantly, the results of this research provide clear next steps for further research, which can provide an even stronger understanding of a program that is poised to continue transforming public housing for the next decade.

## Data Analysis

The first step of the data analysis process was an exploratory analysis of the dataset. Figure 7 shows a table of summary statistics of the. conversions included in the dataset. As of February 22, 2022, 1,467 projects have closed since the inception of the program, which accounts for 157,305 units converted. Additionally, there were 446 projects with CHAPs awards and 96 with Financing Plans Submitted. For the purposes of this analysis, these two categories will not be included in the decision tree because there is incomplete data available.

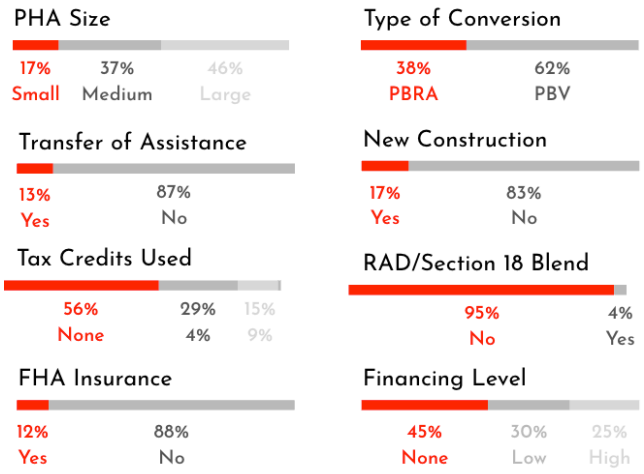



*Figure 7 – Overview of variables in Decision Tree Algorithm*

Table of Data Set Characteristics

It was also useful to look at how the number of conversions has changed over time, both the number of projects and the number of units. It was interesting to see the high number of

conversions in 2015. This highlights the limitation of the HUD evaluation report, whose interviews only included conversions that received their CHAP in 2013.

Other researchers have conducted further analysis on RAD conversions (Schwartz 2017). Therefore, the goal of this analysis is not to complete further analysis of the administrative data available, but the initial exploration of the dataset was still helpful to become familiar with rad conversions. However, it should be noted that continued analysis should be conducted on an ongoing basis as part of monitoring and evaluation. The unique approach of this research was to expand on the prior analysis and use the decision tree algorithm to reveal trends and inform the qualitative interviews.

The decision tree analysis illuminated a number of large clusters of common conversion typologies. When the algorithm's depth was not restricted, the tree became incredibly complex.

| | Description of Variables | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Financing Level per Unit |
| 1 | 202 | Small: 0<br>Medium: 0<br>Large: 202 | PBV | No | No | No | No | No | None: 168<br>Low: 33<br>High: 1 |
| 2 | 170 | Small: 0<br>Medium: 170<br>Large: 0 | PBV | No | No | No | No | No | None:150<br>Low: 20<br>High: 0 |
| 3 | 104 | Small: 0<br>Medium: 0 Large: 104 | PBRA | No | No | No | No | No | None: 86<br>Low: 18<br>High: 0 |
| 4 | 86 | Small: 86<br>Medium: 0 Large: 0 | PBV | No | No | No | No | No | None: 70<br>Low: 16<br>High: 0 |
| 5 | 76 | Small: 0<br>Medium: 76<br>Large: 0 | PBRA | No | No | No | No | No | None: 73<br>Low: 3<br>High: 0 |
| 6 | 74 | Small: 74<br>Medium: 0<br>Large: 0 | PBRA | No | No | No | No | No | None: 65<br>Low: 9<br>High: 0 |
| 7 | 47 | Small: 0<br>Medium: 0<br>Large: 47 | PBV | No | No | 4 % | No | No | None: 0<br>Low: 24<br>High: 23 |
| 8 | 41 | Small: 0<br>Medium: 41<br>Large: 0 | PBV | No | No | 4 % | No | No | None: 0<br>Low: 33<br>High: 8 |
| 9 | 36 | Small: 0<br>Medium: 0<br>Large: 36 | PBRA | No | No | 4 % | No | No | None: 0<br>Low: 31<br>High: 5 |
| 10 | 29 | Small: 0<br>Medium: 0<br>Large: 29 | PBRA | No | No | 4 % | Yes | No | None: 0<br>Low: 24<br>High: 5 |

*Figure 8 – Top Ten Classification Clusters*

The first observation is the high number of Large PHA conversions in the top 10, with 48% of the conversions. This is somewhat expected given that large PHAs have more buildings that could be converted. However, only 73 different large PHAs have participated in the program, of which only 58% of large PHAs. This is consistent with Schwartz's findings, which found a substantial amount of large PHAs not participating in the program (2017)[3]. However, contrary to Schwartz's findings, large PHAs now account for 16% of PHAs, or 73 different large PHAs, up from 24 or 7% (2017). In contrast, only 28 medium PHAs have participated, accounting for 37% of all conversions. Finally, only 191 of 2,323 small PHAs have participated and converted 245 of 1,467 total. Notable Large PHAs that have not participated are Los Angeles, CA, Dallas, TX, New Orleans, LA, and San Antonio, TX.

Another key difference from Schwartz's analysis is the share of conversion that used PBVs v. PBRAs. He found that "Slightly more than half of all RAD projects are slated for PBV [54.9%] and slightly less than half for PBRA [45%]" (Schwartz 2017, 794). However, the overwhelming majority of conversions in the last five years have utilized PBVs, which makes the PBVs now account for 62% of projects and PBRAs only 38%. This will be a crucial question for PHAs to understand why they decided between the two options.

Public housing residents and housing advocates still remember the displacement caused by HOPE VI, and therefore transferring assistance to a new location may sound desirable. However, of the 1,467 conversions, only 190 (13%) include a transfer of assistance. The critical

[3] Schwartz categorizes the largest PHAs as 1,000+ units. This analysis used 1,249+ units, which provides and even more stark increase in large PHA conversions

part of this analysis is understanding how the other variables interact with this variable. For example, 110 conversions with the transfer of assistance include some new construction.

Additionally, 133 of these projects utilize some tax credit financing: 77 use 4%, 55 use 9%, and one uses both 4 and 9%. Finally, only 47 included a transfer of assistance by April 2016, when Schwartz completed his analysis. Since then, 146 have used the transfer of assistance, but the average number of projects per year (~30) has not increased since that analysis. Therefore, understanding how this decision is made will be critical to fully understanding how this will impact residents.

Two hundred fifty-one projects had some new construction. The top clusters that included new construction all utilized tax credits. It is not surprising that 188 of these projects were categorized as a high debt conversion, but notably, 18 of these projects did not take on any debt. This is quite surprising, and it would be interesting to understand how these conversions funded new construction. The top five clusters all utilized PBV, but 91 projects (36%) did use PBRA.

The use of tax credits has caused advocates to raise eyebrows because of the need to transfer the asset to an entity that facilitates the tax credits. Four hundred and twenty-two conversions included 4% tax credits. Three of the top 5 clusters included PBV, while 2 used PBRAs. This is notable because with PBRAs, and depending on the tax credit entity, the housing authority may have little to do with operations of the converted building. None of these top clusters included a transfer of assistance and only 77 all tax credits did. Additionally, only 96 conversions included new construction, and none of the top 5 clusters of 4% tax credits involved new construction. Two of the top five 4% clusters received FHA insurance.

On the other hand, 9% tax credits were far less common, with only 217 conversions.

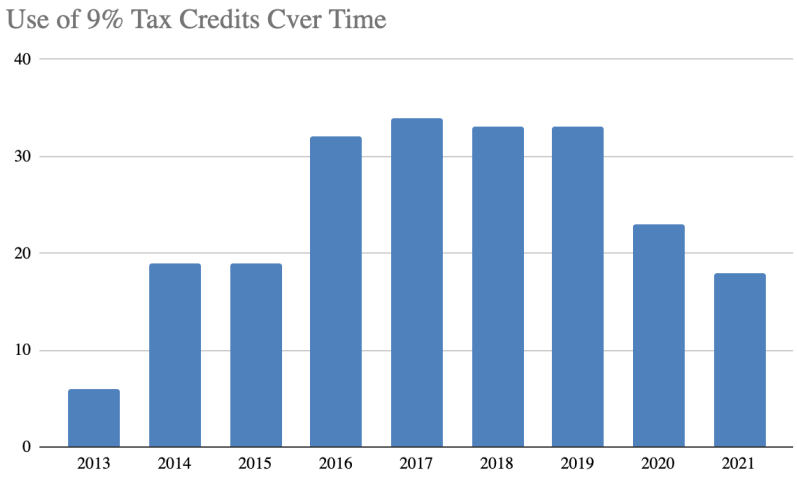



*Figure 9 – Use of 9% Credits over time*

Only one of the top 5 9% clusters used PBRA, which is odd because of 100 of 217 PRBA conversions. However, this is slightly higher than the overall percentage. Of these top clusters, two involved new construction. Unlike the 4% clusters, FHA insurance was far less common. It was not in any of the top clusters and only happened 23 times overall. There was a curious distribution of 9% tax credits over time. Further analysis will be needed to understand this trend and was included in the qualitative analysis.

One of the most surprising results was the lack of FHA insurance. Only 171 of 1,476 projects included insurance, and the top five clusters account for over 50% of the total. Four of the top clusters involve 4% tax credits, which makes sense given section 542(c) Housing and Community Development Act of 1992. This allows Participating qualified State and local Housing Finance Agencies to "provides credit enhancement for mortgages of multifamily housing projects whose loans are underwritten, processed, serviced, and disposed of by HFAs. HUD and HFAs share in the risk of the mortgage." However, while 87% of FHA-insured loans

involve LIHTC, only 19% of LIHTC conversions involve FHA insurance. This observation informed the questions for PHA officials.

RAD Section 18 blends do not make up a large group since this only began in 2018, but since then, it has been used by a variety of PHAs. In all but one of the top five section-18 clusters, 4% tax credits were used. 4% tax credits were used in 62 of 69 conversions with the section-18 blend. These are among the highest debted conversions at $185,709 per unit. It is unclear why a PHA would choose to use PBRA along with the section 18 blend because they would still have to administer the tenant protection vouchers that result from the section 18 disposition. Nonetheless, one cluster in the top five used PBRA, and 15 conversions used a section 18 blend and PBRA.

Finally, it is noteworthy that most of the conversions in the top 10 (612 of 865) occur with no debt, including tax credits. Of the top 10 most significant clusters, no-debt was the largest category in six. Only the clusters that included tax credits were low or high debt the largest. This counters many of the RAD's privatization critiques and suggests PHAs see a value in entering into long-term stable contracts rather than remain at the whim of yearly political appropriations even if their buildings do not need extensive rehabilitation. These no-debt conversions are over-represented in the top 10 clusters since. Overall, there are 663 no-debt conversions out of 1,467 (approx. 45%)

With the decision tree illuminating several conversion types, some key questions arose. For example, why are no-debt conversions so popular? Why use PBV or PBRA? Why was FHA insurance so uncommon? When was new construction the right decision, and how does the transfer of assistance play into that decision? These questions are all important to further our understanding of how RAD is implemented and better understand how these decisions impact

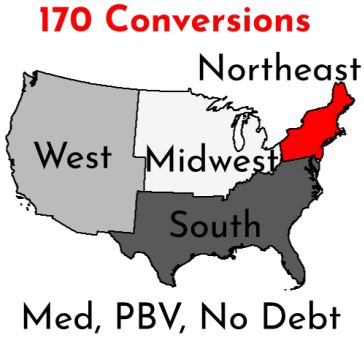
the lives of residents. The following section will provide a spatial analysis of where these common clusters occur.

## Spatial Analysis on Clusters

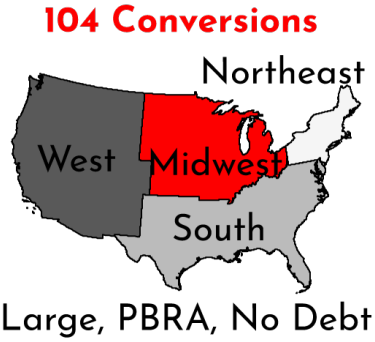
The decision tree provided information about how conversions happened. This section takes that analysis a step further by asking where these conversions are taking place? Drawing on Abt. Associates' 2010 report, *Capital Needs in the Public Housing Program,* prepared for HUD, uses the same four Census regions (Northeast, Midwest, South, and West) to draw comparisons between their capital need assessments and the conversion type discussed above. The maps below show a heat map of the top 10 most significant clusters.

*Figure 10 – Regional Analysis of Top Ten Groups*


**Spatial Distribution of Cluster 1**

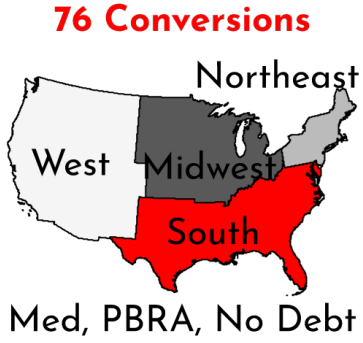



**Spatial Distribution of Cluster 2**



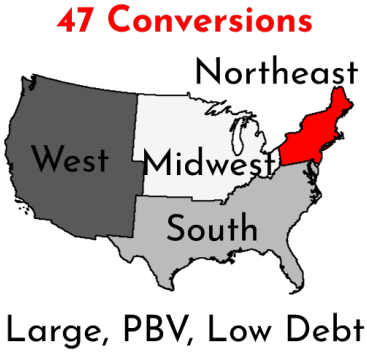

**Spatial Distribution of Cluster 3**


**Spatial Distribution of Cluster 4**

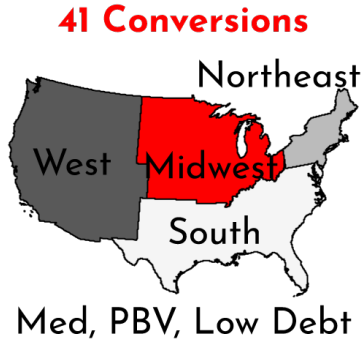



**Spatial Distribution of Cluster 5**

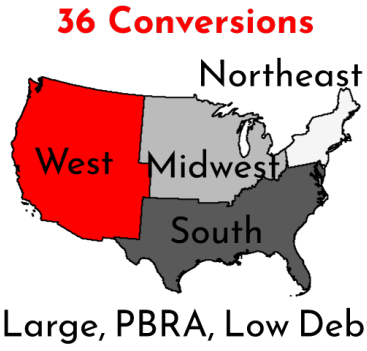

**Spatial Distribution of Cluster 6**



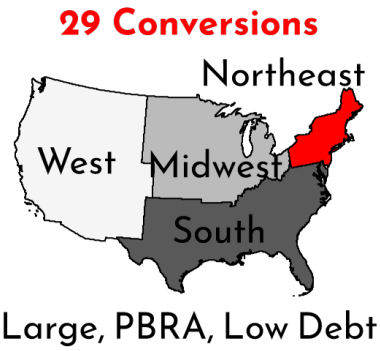

**Spatial Distribution of Cluster 7**




**Spatial Distribution of Cluster 8**




**Spatial Distribution of Cluster 9**




**Distribution of Cluster 10**

This analysis helped inform the recruitment of PHA professionals, private sector developers, and development consultants that have experience with RAD conversions. While not

always successful, particular interest was taken to provide a representative sample of experiences, locations, and conversion types.

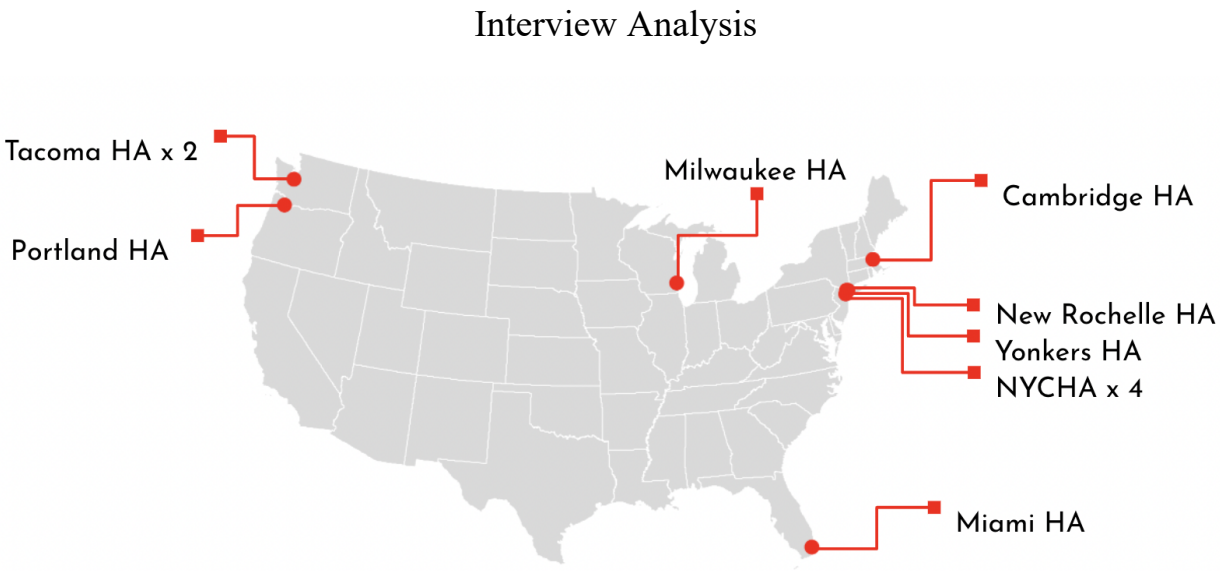



*Figure 11 – Map of Interviews conducted*

Altogether, eleven individuals responded and were willing to be interviewed about their experience with RAD conversions. These individuals had varying degrees of knowledge about over 60 conversions. Among these conversions, 26 fit into the top identified cluster, ten were in the second largest cluster, and eight were in the sixth-largest cluster (see above). The rest of the projects fit into smaller clusters with more variation, which allowed for helpful discussion about the decision-making process. There were significant local differences among all the PHAs, but had common takeaways.

All the PHAs interviewed used PBV. None of the conversions discussed used PBRA. This decision appeared to be based on two key considerations: The admin fee and the current

voucher program. First, the admin fee provided by PBV is a critical funding source for PHAs to cover operating costs. This also allows for more oversight and continued involvement of the PHA in the building's operations. Even in examples where private management is used, use of PBV is contingent on the PHA having a voucher administration team that can absorb the increased vouchers. The majority of PHAs interviewed were large PHAs with robust voucher programs, so they were all able to handle this increase. On the other hand, PBRA can allow for higher rents. In this case, it may be necessary to use PBRA to help with the funding.

The second key takeaway was the useful ability of RAD to cover the extensive capital needs. However, it was clear there were differences between the PHAs. All PHAs focused on improving building systems, such as water lines, sewers, electrical equipment, and elevators. Additionally, seismic improvements were a focus of the west coast PHAs. Behind building systems, common areas and community centers were the next common focus. It appeared that the goal of PHAs was to improve things that impact the most residents and provide the ability for PHAs to preserve housing over the long term. Many of these buildings were built in the 1970s, and the systems have not been updated. This does mean that unit renovations were not always completed to the point some PHAs had hoped. It seemed as though PHAs with more resistant residents focused more on unit improvements, perhaps to appease wary residents. In contrast, PHAs with residents more amicable to the conversions seemed to focus on a holistic systems approach. Overall, the overwhelming majority of the capital needs have been addressed.

Some PHAs expressed concern about completing Housing Quality Standards inspections prior to beginning work. The section 8 program requires a third-party inspection of a unit prior to the contracts. However, in examples where units need extensive work, they are likely to fail the initial inspection. As a result, PHAs would be required to complete work to pass the inspection

before an extensive rehab is completed. In one example, in New York City, well known for having extensive needs, NYCHA paid millions of dollars on temporary maintenance that was then readdressed more permanently. This requirement was relaxed during covid. However, this temporary work seems to cause more disruption in residents' lives and increases the total cost of renovations.

Three PHAs were Move-to-Work agencies, which has provided them with more flexible funding options. As discussed in Chapter 2, MTW agencies have utilized private funding and tax credits for time and have experience with and partnerships with lenders and tax credit equity partners. MTW has also allowed PHAs to begin thinking more holistically about their portfolio prior to the RAD program. For example, Cambridge Housing Authority, Tacoma Housing Authority, and Portland Housing Authority have been investing in their development departments. Therefore, they have strong teams, allowing them to complete the conversions without bringing on a development partner. One official said, "it is much easier to walk into a closing with three people" when referring to the tax credit investor and the construction lender. It should be noted that many of these MTW agencies are high-performing agencies, and they have extensive experience with Housing Choice Vouchers, which makes them ideally situated to benefit from a program like RAD. However, some distinct issues have limited their implementation.

On the other end, interviewees at PHAs that have had issues such as lawsuits and receivership have taken an approach. The approach for these projects has been a long-term ground lease, so the PHAs retain ownership of the site and enter into a developer agreement to take on the responsibilities of rehab and management. These cases follow the trends that many critics put as privatization. However, two points complicate that assertion. First, ownership does

not necessarily have to change hands. If tax credit financing is not used, a new entity does not even need to be created. Second, the development agreement often includes extensive requirements that the management must follow, which is far beyond the scope of any private property manager. Still, one PHA official pointed out that restrictions due to receivership have put them in a weaker position when negotiating with their development partners. As a result, one developer has been responsible for almost 90% of that city's conversions. This highlights the importance of the robust RFP process. If a PHA is disadvantaged negotiating the developer agreement, more work upfront with the RFP process could help address those shortcomings.

A noticeable observation was the additional community engagement work that every PHA completed prior to conversion. HUD requires two community meetings, but many PHAs have completed considerably more. PHAs have continued to engage with residents throughout the process and included resident input in rehab design. For example, one of the conversions in New York City installed two sinks in their kitchens for their Hasidic residents to assist with kosher needs. Additionally, residents are now included in NYCHA's RFP process and helping to select the development partners. For example, to the surprise of one interviewee, residents of NYCHA's Chelsea sites chose Related Companies after reviewing proposals from both nonprofit and for-profit options. This decision shows how important it is to include residents in the process because sometimes their choices might differ from those made by someone who thinks they know what tenants want or what is best for them. Additionally, including residents in this RFP process can address the developer agreements concerns mentioned in the preceding paragraph.

One key focus of the interviews was understanding why PHAs had waited so long to adopt RAD. As Schwartz pointed out in the analysis of RAD based on 2016 data, "Northeastern PHA… are underrepresented," which appears to have been due to the region's high construction

and operating costs. From the Cambridge and New York City examples, the RAD/section 18 was necessary to make the conversions work, which only started in 2017. The Tenant protections vouchers often garner higher rents than the traditional RAD rents, so bundling buildings with RAD rents and others with Section 18 allowed the numbers to work out. One interviewee did mention the frightening name of section 18, "disposition" did alarm some tenants, and continued engagement was necessary to understand this complicated process. Since this only began in 2018, it will be necessary to continue to monitor how this is being utilized.

One common issue raised by several interviewees was the difficulty of working with the city on permitting. Many city departments are also underfunded and understaffed, and these large projects, which often involve multiple buildings, create difficulty managing inspections and signoffs from all the requisite departments. In particular, if there are any environmental issues, delays in sign-offs after clean-up is complete can hold up deferred developer fees that the PHA dramatically needs.

RAD has predominantly used a rehab tool for everyone interviewed. However, one interviewee planned to use the transfer of assistance and new construction to consolidate several smaller scattered-site units. In this case, residents would sign a new section 8 lease two years before they have the opportunity to move into the new units. In most cases, residents can convert their units to mobile vouchers after one year, but in this case, residents would have to wait until they are in the new unit for one year. That means these residents would have to wait three years before they are eligible to exercise a key tenant-right from this program. While this housing authority is working to provide more opportunities for these tenants, other PHAs may not be willing to go above and beyond. More work is needed to understand the lived experience of

residents of conversion that involve a transfer of assistance, particularly when new construction is involved.

It was also unclear how many residents took advantage of those mobile vouchers. Many interviewees mentioned that residents found that option appealing, but anecdotal evidence suggested it was not very common. Interviewees described the high moving costs that mobile vouchers do not cover. Others mentioned the difficulty of finding a unit with the voucher in the same community, especially if they are in a high-rent area. Still, some comments focused on the residents liking the newly rehabbed building. They have newly renovated apartments in their original buildings, so there is not much impedance to leaving. These anecdotal stories provide a positive outlook for residents after conversions, but there should be more work to confirm these stories.

In conclusion, these interviews provided an insight into the thought process of PHAs who have implemented RAD conversions. The apparent desire to convert to a more stable funding source and the opportunity to address long-standing capital needs requirements comprehensively have resituated many PHAs. Instead of reactively addressing problems, PHAs can now proactively plan to provide better service to their current residents and expand housing options for new families.

# Chapter 6: Discussion & Conclusion

## Discussion

The decision tree results, coupled with qualitative interviews, made three points very clear:

1. RAD conversions do not occur the way the media portrays them.
2. More targeted work needs to be done to understand residents' experiences during and post-conversion.
3. Now is time to start planning for the 15-year exit period of the LIHTC funding and its implications for PHAs and their residents.

While RAD conversions appear to be successful at recapitalizing ailing public housing without leading to displacement, much of the initial skepticism did lead to better outcomes. Therefore continual but nuanced skepticism is needed to ensure the program works to provide safe and affordable housing to the nation's most vulnerable populations. Calls for end RAD end seem like a blunt critique that misses the complexity and nuance of different conversions. This point is not meant to give HUD and PHAs a pass to implement what program they would like. Instead, it is crucial to focus on identifying specific shortcomings and then work together to create solutions. It is easy to decry RAD as a tool to privatize public housing. This thesis began as an attempt to show this using a mixed-methods approach. However, the results speak for themselves and beg for a more nuanced approach moving forward.

The overwhelming amount of no debt conversions means there is no transfer of ownership and, therefore, no privatization. These conversions mean very little for the residents' lives but are transformative for PHAs' operation, management, and planning. Other conversion types may

draw more attention because of the amount of private involvement in private capital. It is not surprising that 44% of surveyed NYCHA residents opposed RAD, and their top three reasons were gentrification, privatization, and distrust of NYCHA (Bach et al. 2020). Herein lies the problem: residents do not trust private developers, and they do not trust NYCHA. Given the history of racism, discrimination, segregation, chronic poverty, the school-to-prison pipeline, and every other failure of this nation, this finding should shock no one. Deteriorating public housing came about due to political decisions to chronically underfunded public housing, but many PHAs did not do themselves any favors by consistently mismanaging their buildings. Now RAD provides the only lifeline available. However, the decision between living with mold or asbestos and privatization does seem to provide misaligned and unbalanced options. At the same time, many PHAs are so broken that simply adequately funding them does not guarantee better outcomes. For example, before the 2018 federal lawsuit, NYCHA did not have an asset management department. The largest PHA in the country, housing a population large enough to rank as the 34th most populous city in the nation, did not have a department devoted to comprehensively understanding its buildings' needs (Nycha Fact Sheet 2021). Public housing was a hallmark of the New Deal, but the nation has changed for better or worse, and public housing needs to change too.

Even if public housing is changing, there is still room for residents and housing advocates to push for further reforms for RAD. The analysis identified ten recommendations to improve RAD conversions.

1. More research is needed to understand how the 15-year LIHTC exit interacts with the 20 year HAP contract.
2. Tenant groups should be included in all RFP processes and design decisions

3. States should development a Public Trust to provide and all public option
4. LIHTC allocations should be adjusted so RAD conversions do not crowd out other projects
5. HUD should evaluate the efficacy of requiring Housing Quality Standards inspections prior to extensive rehab
6. HUD should require PHAs to implement 1 year tenant surveys to understand how residents perspective of RAD
7. HUD should develop capacity building programs to assist city departments with permitting RAD conversions
8. Community engagement needs to be trauma-informed
9. HUD should work to build development capacity of PHAs
10. HUD should better understand why FHA insurance is so infrequently utilized and if there are other methods to provide foreclosure assurances

The goal of these recommendations is to ensure the needs of residents are heard and residents are given agency in their future. Leaning on Arnstein's ladder of Citizen Participation, current HUD requirements only meet the Tokenism level. The two required meetings seem only to reach level three; informing, or maybe level 4: consultations. Many of the PHAs interviewed for this thesis have gone above this level, and HUD should take steps to increase the community engagement process in a trauma-informed manner. Housing Authorities like NYCHA that have gone as far as including residents in the RFP process are clearly in the Citizen Control group at level 6: Partnership. This approach should be replicated in other locations, especially when PHAs are not going to complete the development themselves. However, residents should be included in the design process even in these cases.

The next set of recommendations focuses on the option available to PHAs and residents. The Public Trust option, like the one proposed in New York, would provide an additional option on top of nonprofit and for-profit partners. However, it should still be up to the residents and PHA to decide what is best for them, and this provides an option that does not have involve any level of "privatization." Additionally, Schwartz showed how RAD conversions are eating into

state LIHTC allocations, so work needs to be done to make sure RAD conversions do not reduce the expansion of new affordable housing units.

Other recommendations focus on making rehab easier for the PHA and the residents. Permitting difficulties can delay projects, and HQS inspections before rehab appear to be more disruptive to residents and expensive for PHAs to make temporary fixes. More work is needed to understand what inspections are necessary, and lessons learned from the reduced requirements during the COVID-19 pandemic could be a great starting point. These conversions would also be an excellent opportunity to help PHAs build their development capacity, making for stronger PHAs and more opportunities to expand housing options.

In fact, by removing these units from the registry of public housing, many PHAs are now under Faircloth cap. For the first time in generations, PHAs have the opportunity to build more public housing and expand their portfolio. Faircloth-to-RAD was outside the scope of this thesis, and more work should be done to understand its implications. New mechanisms for producing housing for low-income residents should be welcomed with nuanced skepticism.

While a great deal of RAD skepticism stems from a history of being let down and disregarded by the public and private sectors, it is worth noting that there is not much of an attempt to highlight the benefits. While the qualitative interviews provided anecdotal evidence that residents have favorable views of converted properties, HUD and PHAs need to do more to formalize this data. NYCHA has been giving tours of converted sites, and there was one survey conducted, but more can be done to showcase the positive outcomes and could go a long way to sway the many skeptics who remain concerned about what RAD means for Public Housing.

Finally, while these conversions have led to a positive outcome and addressed the current problem of excessive capital needs requirements, it is still unclear what the future will look like.

One area of concern is what happens at the end of the year tax credit period. The current HAP contracts have a 20-year term, so there could be between 3-5 years left on the HAP contracts at the end of the tax credit period. Many states have extended use periods that ensure LIHTC properties stay affordable, and the HAP contracts must be renewed in perpetuity. However, it is unclear what this could mean in terms of financing options. The short time left on the HAP contract could make it difficult to obtain financing, and after 15 years, there are likely to be new capital requirements. Standard exit options include selling the property or refinancing, but it is unclear what will happen since this has not happened yet. PHAs have the right of first refusal, but there is a good chance the property's value has increased. PHAs should begin preparing for this 15 exit, and HUD should issue further guidance.

The benefit of the decision tree is that now it is possible to identify priority buildings for further investigation. For example, the interviews provided information that PBVs allowed for more PHA involvement than PBRA, transfer of assistance was more disruptive to residents, and new construction would lead to an erosion of the tenant's rights to convert to a mobile voucher in a reasonable period. The use of tax credits makes the 15-year exit unclear. Together 30 conversions fit the criteria of PBRAs, transfer of assistance, new construction, and tax credit. Additionally, only two projects were in different clusters because they used FHA insurance. A complete list of these properties can be found in Appendix A. Further research should begin by understanding the residents' lived experiences at these properties and how the PHAs came to these decisions. Further skepticism and analysis are warranted, but identifying 30 properties for further research is different from claiming all RAD conversions are privatizing public housing.

## Limitations

There are some clear limitations of this research. First, concerning the decision tree, there is no attempt to normalize the data based on the size of the PHA. The most significant clusters in the top ten have various PHAs. However, toward the bottom of the top 10, large PHAs may have impacted rankings. Just because Baltimore converted 17 developments the same way, should a cluster of 27 make it into the top ten? There may be other clusters with further projects, but a more diverse group of PHAs may lead to a more representative analysis. However, normalizing the number of units a housing authority owns would be excessively time-consuming. If the HA used a section 18 blend and "disposed" of public housing, it would be removed from the public housing database and could result in uninterpretable results information. Altogether, this has skewed the results toward larger PHAs. Further research could attempt to find a way to group these similar conversions of the same PHA to reduce this skew.

Another major limitation was the data availability. While the dataset provided by HUD does include many valuable variables, it would be helpful to have data available on the capital needs assessments and the resulting ownership structure. The RAD Conversion Commitment document provides the data in a concise format, and providing this information to the public would help further research.

Finally, the decision tree helped identify different clusters; the PHAs that responded to the recruitment messages were not representative. The PHAs were larger and more likely to describe all the positive work they were doing. This may skew some results to present an overly optimistic program view. Further research should focus on speaking to different PHAs to better understand their experiences.

# Conclusion

Public housing has seen so many iterations its 80 year existence. Public opinion has shifted, and the funding necessary to provide safe and healthy homes has been non-existant. At the same time, policy changes over throughout the 20th century have shifted the demographics of public housing residents to the lowest income families, which is disportionately families of color (Scwartz 2015). The role and importance of Public Housing can not be understated. As one interviewee mentioned, "if a resident is struggling to stay in our housing, what chance will they have anywhere else?" The country needs public housing, but the country needs strong public housing. For too long Public Housing residents have waited for mold to be removed, toilets to work properly, and their heat to work, while politicians have courted their votes. The public sector has failed these residents for generations, and now everyone expects the private sector to be the answer. Public housing has always been a battleground in the fight between the public and private sectors (Vale and Freemark 2019). However, this framing missing a key constituency: the residents.

This thesis has used a mixed method approach to more fully understand RAD conversion and what they mean for the future of US public housing. The results show that RAD is not the privatization boogey man many claim it to be, but it is not without its faults. Occupied rehabs are always difficult, but overlapping certifications and inspections can add undue burden on residents, and relying on LIHTC financing can syphon allocation away from building new affordable housing. Furthermore, RAD does nothing to facilitate resident control in the process. Many cities has adopted more participatory conversions, but need to go further.

Chapter 2 covered two problems with public housing; capital needs and management. While this thesis shows RAD undoubtedly provides funds available for rehab, there could be

more done to include residents in the management of buildings. There can be training programs and employment opportunities to help residents take an active role in their shaping the future. The true failure of public housing has always been how policy maker treat low income people and communities of color, particularly black community, and this stretches far beyond the realm to public housing. Until our nations grapples with these injustices, there will still be issues facing public housing. Evaluations of RAD therefore requires nuanced and complex analysis to understand the benefits it provides albeit in an unjust system.

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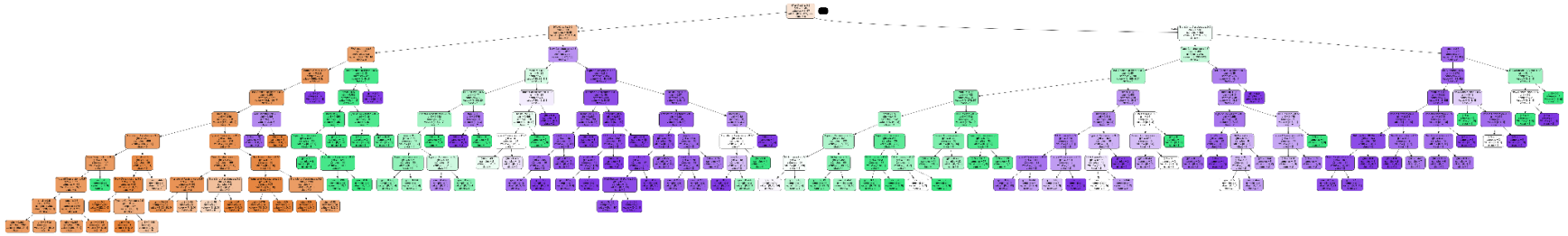
# Appendix

## A. Identified Conversion for Further Research

| ST | PHA Name | Development Name | Closing Date | PHA Size | Tax Credit per Unit | Hard Debt per Unit |
|---|---|---|---|---|---|---|
| TN | Murfreesboro Housing Authority | MURFREESBORO HOUSING PHASE 2 | 8/18/2021 | 2 | $161,605.46 | $74,324.32 |
| TX | Housing Authority of the City of El Paso | PATRIOT PLACE | 5/3/2021 | 3 | $125,087.36 | $26,045.45 |
| OH | Cuyahoga Metropolitan Housing Authority | NEW CARVER PARK PHASE 4 - TOA | 11/5/2020 | 3 | $101,369.24 | $85,697.33 |
| NM | Santa Fe Civic Housing Authority | 1115 CALLE LA RESOLANA CAT1A | 10/15/2020 | 2 | $635,050.82 | $276,363.64 |
| OH | Cuyahoga Metropolitan Housing Authority | FAR WEST PHASE III | 4/21/2020 | 3 | $113,365.46 | $93,137.25 |
| MD | Housing Opportunities Commission of Montgomery County | ELIZABETH HOUSE III | 3/31/2020 | 3 | $440,075.00 | $630,175.15 |
| IL | Montgomery County Housing Authority | THE HILLS | 9/30/2019 | 1 | $251,406.04 | $33,826.30 |
| MD | Housing Opportunities Commission of Montgomery County | ELIZABETH HOUSE | 7/30/2019 | 3 | $205,173.47 | $205,400.00 |
| TX | Fort Worth Housing Solutions | STALLION RIDGE | 6/6/2019 | 3 | $669,900.00 | $1,089,750.00 |
| TX | Fort Worth Housing Solutions | PATRIOT POINTE | 4/11/2019 | 3 | $616,590.91 | $1,021,818.18 |
| TX | Fort Worth Housing Solutions | BUTLER PLACE APTS A (Palladium) | 4/10/2019 | 3 | $929,907.00 | $858,133.33 |
| AZ | Housing Authority of Maricopa County | MARICOPA COUNTY HA/PARKVIEW ESTATES | 12/14/2018 | 2 | $114,142.61 | $80,000.00 |
| TX | Housing Authority of the City of El Paso | J D CRAMER MEMORIAL (J) (Roosevelt) (Medano Hghts) | 12/10/2018 | 3 | $95,203.25 | $50,546.10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| TX | Housing Authority of the City of Fort Worth Texas D/B/A Fort Worth Housing Solutions | BUTLER PLACE APARTMENTS J (Campus Apts) | 10/31/2018 | 3 | $0.00 | $0.00 |
| VA | Newport News Redevelopment & Housing Authority | NEW LASSITER COURTS | 10/26/2018 | 3 | $74,800.00 | $23,000.00 |
| AZ | Housing Authority of Maricopa County | CLARE FELDSTADT HOMES C | 6/28/2018 | 2 | $254,438.84 | $17,857.14 |
| VA | Richmond Redevelopment & Housing Authority | FAY PHASE III | 6/14/2018 | 3 | $105,290.82 | $57,944.44 |
| MD | Housing Opportunities Commission of Montgomery County | TOA 900 THAYER LP | 1/31/2018 | 3 | $184,320.91 | $190,476.18 |
| TX | Housing Authority of the City of El Paso | SALAZAR / COMMISSIONER'S CORNER II | 12/13/2017 | 3 | $55,523.43 | $57,826.09 |
| TX | Housing Authority of the City of El Paso | SALAZAR / COMMISSIONER'S CORNER I | 12/11/2017 | 3 | $139,299.01 | $45,322.58 |
| WI | Merrill Housing Authority | PARK PLACE & WESTGATE | 11/1/2017 | 1 | $83,362.50 | $40,340.12 |
| CA | Housing Authority of the City of Fresno California | FRESNO EDISON | 4/21/2017 | 3 | $240,281.33 | $45,250.00 |
| IL | Montgomery County Housing Authority | KIRK TERRACE | 7/19/2016 | 1 | $191,159.65 | $0.00 |
| CA | Housing Authority of Fresno County California | SHOCKLEY TERRACE | 3/18/2016 | 2 | $487,031.24 | $0.00 |
| AZ | Housing Authority of Maricopa County | MADISON HEIGHTS PHASE I | 9/30/2015 | 2 | $184,782.97 | $18,318.70 |
| AZ | Housing Authority of Maricopa County | MADISON HEIGHTS PHASE II | 9/30/2015 | 2 | $175,601.09 | $22,652.89 |
| IL | Housing Authority of the County of Cook | JANE PERLMAN APTS | 1/30/2015 | 3 | $78,206.03 | $17,085.43 |
| IL | Housing Authority of Elgin | CENTRAL PARK TOWERS | 12/31/2014 | 2 | $105,236.40 | $50,029.53 |
| NC | Housing Authority of the City of Salisbury | CIVIC PARK 1 | 7/30/2014 | 2 | $167,205.50 | $66,666.67 |
| IL | Menard County Housing Authority | PETERSBURG | 4/24/2014 | 1 | $129,008.90 | $72,745.15 |

B. Complete Developed Decision Tree



## C. Identified Clusters

Top Five High Debt Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 24 | Small: 0<br>Medium: 0<br>Large: 24 | PBV | No | No | 4 % | No | No | $221,126.33 |
| 2 | 21[4] | Small: 0<br>Medium: 0<br>Large: 21 | PBV | Yes | No | 4 % | No | No | $334,090.22 |
| 3 | 18 | Small: 0<br>Medium: 18<br>Large: 0 | PBV | Yes | Yes | 4 % | No | No | $266,273.50 |
| 4 | 17 | Small: 0<br>Medium: 0<br>Large: 17 | PBV | No | Yes | 4 % | No | No | $308,822.92 |
| 5 | 17 | Small: 0<br>Medium: 17<br>Large: 0 | PBV | No | Yes | 9 % | No | No | $206,967.21 |

[4] All the Housing Authority of the City & County of San Francisco

Top Five Low Debt Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 33 | Small: 0<br>Medium: 33<br>Large: 0 | PBV | No | No | 4 % | No | No | $79,225.15 |
| 2 | 33 | Small: 0<br>Medium: 0<br>Large: 33 | PBV | No | No | No[5] | No | No | $38,593.03 |
| 3 | 29 | Small: 0<br>Medium: 0<br>Large: 29 | PBRA | No | No | 4 % | No | No | $78,818.64 |
| 4 | 25 | Small: 0<br>Medium: 25<br>Large: 0 | PBV | No | No | 4 % | Yes | No | $75,580.94 |
| 5 | 23 | Small: 0<br>Medium: 0<br>Large: 23 | PBV | No | No | 4 % | No | No | $70,915.30 |

[5] Two Conversions were labeled with no Tax credits but had a value in the "Tax Credit Amount" field

Top Five No Debt Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 168 | Small: 0<br>Medium: 0<br>Large: 168 | PBV | No | No | No | No | No | $0 |
| 2 | 150 | Small: 0<br>Medium: 150<br>Large: 21 | PBV | Yes | No | No | No | No | $0 |
| 3 | 86 | Small: 0<br>Medium: 0<br>Large: 86 | PBRA | No | No | No | No | No | $0 |
| 4 | 73 | Small: 0<br>Medium: 73<br>Large: 0 | PBRA | No | No | No | No | No | $0 |
| 5 | 70 | Small: 70<br>Medium: 0<br>Large: 0 | PBV | No | No | No | No | No | $0 |

Top RAD/Section 18 Blend Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 16 | Small: 0<br>Medium: 0<br>Large: 16 | PBV | No | No | 4 % | No | Yes | $198,531.03 |
| 2 | 10 | Small: 0<br>Medium: 10<br>Large: 0 | PBV | No | No | 4 % | No | Yes | $149,491.33 |
| 3 | 7 | Small: 0<br>Medium: 0<br>Large: 7 | PBV: 6<br>PBRA: 1 | No | Yes | 4 % | Yes:1<br>No: 6 | Yes | $256,348.14 |
| 4 | 6 | Small: 0<br>Medium: 0<br>Large: 6 | PBV | No | No | No | No | Yes | $155,813.29 |
| 5 | 6 | Small: 0<br>Medium: 0<br>Large: 6 | PBRA | No | No | 4 % | No | Yes | $148,539.70 |

Top Transfer of Assistance Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 23 | Small: 0<br>Medium: 0<br>Large: 23 | PBV | Yes | No | 4 % | No | No | $313,070.47 |
| 2 | 22 | Small: 0<br>Medium: 0<br>Large: 22 | PBV | Yes | No | None | No | No | $0 |
| 3 | 18 | Small: 0<br>Medium: 18<br>Large: 0 | PBV | Yes | Yes | 9 % | No | No | $266,273.50 |
| 4 | 13 | Small: 0<br>Medium: 13<br>Large: 0 | PBV | Yes | Yes | 4 % | No | No | $188,730.89 |
| 5 | 12 | Small: 0<br>Medium: 0<br>Large: 12 | PBRA | Yes | Yes | 4 % | No | No | $260,495.41 |

Top New Construction Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 21 | Small: 0<br>Medium: 0<br>Large: 21 | PBV | No | Yes | 4 % | No | No | $265,063.59 |
| 2 | 19 | Small: 0<br>Medium: 19<br>Large: 0 | PBV | No | Yes | 9 % | No | No | $194,295.41 |
| 3 | 18 | Small: 0<br>Medium: 18<br>Large: 0 | PBV | Yes | Yes | 9 % | No | No | $266,273.50 |
| 4 | 15 | Small: 0<br>Medium: 0<br>Large: 15 | PBV | No | Yes | 9 % | No | No | $264,665.32 |
| 5 | 13 | Small: 0<br>Medium: 13<br>Large: 0 | PBV | No | Yes | 4 % | No | No | $300,786.37 |

Top 4% Tax Credit Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 47 | Small: 0<br>Medium: 0<br>Large: 47 | PBV | No | No | 4 % | No | No | $147,618.81 |
| 2 | 41 | Small: 0<br>Medium: 41<br>Large: 0 | PBV | No | No | 4 % | No | No | $96,271.53 |
| 3 | 36 | Small: 0<br>Medium: 0<br>Large: 36 | PBRA | No | No | 4 % | No | No | $92,892.28 |
| 4 | 29 | Small: 0<br>Medium: 0<br>Large: 29 | PBRA | No | No | 4 % | Yes | No | $117,030.45 |
| 5 | 27 | Small: 0<br>Medium: 27<br>Large: 0 | PBV | No | No | 4 % | Yes | No | $79,792.15 |

Top 9% Tax Credit Clusters

| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 21 | Small: 0<br>Medium: 21<br>Large: 0 | PBV | No | No | 9 % | No | No | $165,155.83 |
| 2 | 19 | Small: 0<br>Medium: 19<br>Large: 0 | PBV | No | No | 9 % | No | No | $194,295.41 |
| 3 | 18 | Small: 0<br>Medium: 18<br>Large: 0 | PBV | No | Yes | 9 % | No | No | $266,273.50 |
| 4 | 15 | Small: 0<br>Medium: 0<br>Large: 15 | PBV | No | Yes | 9 % | No | No | $264,665.32 |
| 5 | 14 | Small: 14<br>Medium: 0<br>Large: 0 | PBRA | No | No | 9 % | No | No | $106,708.28 |

Top FHA Insured Clusters

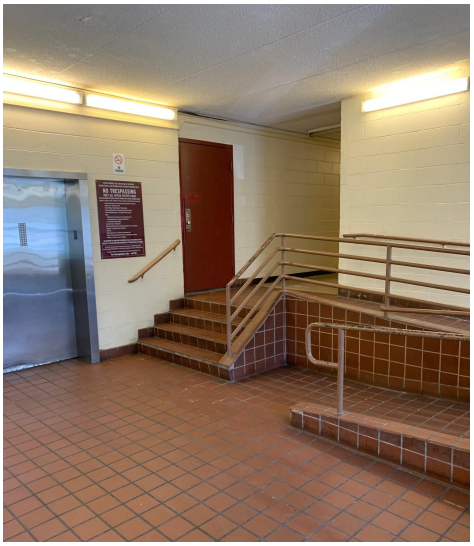
| | | Description of Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Projects | PHA Size | Type of Conversion | Transfer of Assistance | New Construction | Tax Credit | FHA Insured | RAD/ Section 18 Blend | Average Financing per Unit |
| 1 | 29 | Small: 0<br>Medium: 0<br>Large: 29 | PBRA | No | No | 4 % | Yes | No | $117,030.45 |
| 2 | 27 | Small: 0<br>Medium: 27<br>Large: 0 | PBV | No | No | 4 % | Yes | No | $79,792.15 |
| 3 | 14 | Small: 0<br>Medium: 0<br>Large: 14 | PBV | No | No | 4 % | Yes | No | $52,552.56 |
| 4 | 13 | Small: 0<br>Medium: 13<br>Large: 0 | PBV: 4<br>PBRA: 9 | Yes: 1<br>No: 12 | No | No:12<br>Both: 1 | Yes | No | $42,246.84 |
| 5 | 10 | Small: 10<br>Medium: 0<br>Large: 0 | PBV | No | No | 4 % | No | No | $106,708.28 |

D. Pictures from of the Williamsburg bundle RAD/PACT Conversion




Hallway Prior to rehab - Williamsburg, BK

Hallway After Rehab - Williamsburg, BK



Lobby Prior to Rehab - Williamsburg, BK

Lobby Aftero Rehab - Williamsburg, BK

New Larger Trash Chute - Williamsburg

New Community Park - Williamsburg


Smart Boilers to allow for central monitoring

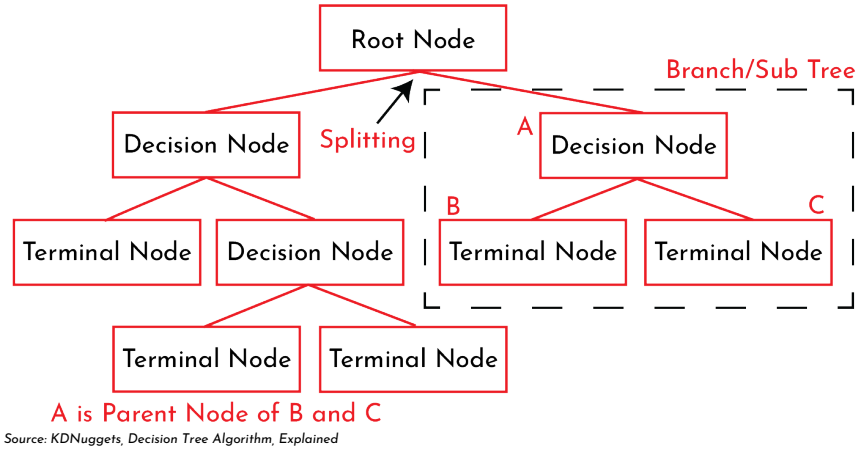
New Bathroom - Williamsburg

Broken Toilet Prior to Rehab - Williamsburg

Sewer work conducted as part of rehab

## E. Decision Tree Algorithms

There is some important terminology that must be explained. A root node is the topmost node of the decision tree, which splits into two separate sets called decision nodes. This process of splitting will continue until the node splits no further at a terminal node. For example, if we have 100 individuals and ask, "is your birthday before June 30?" it would split the root node, all 100 individuals, into two decision nodes, the group that answered yes and the group that answered no. Then suppose the two separate groups are asked, "Do you have brown hair?" one group would split into a terminal node where all the individuals have brown hair and birthdays before June 30, but the group that does not have brown hair might have blonde hair or red hair, and could thus split again.



Source: KDNuggets, Decision Tree Algorithm, Explained

At this point, one might be asking, "how is this machine learning? Can't the researcher do this by hand?" and this answer is yes, but likely not optimally. The goal is to create distinct clusters, and therefore we only want to choose decision nodes that will optimize the Information Gain. To understand how to optimize Information Gain, we first have to understand how to measure the randomness of the data, called the Gini Index. To continue our example suppose 60

people have brown hair, 40 have blonde hair. The probability of choosing a brown-haired person is p(brown) = .6, or 60%. Using the Gini Index formula

$$\text{Gini Index} = 1 - \sum(p(i)^2)$$

Gini Index = 1- ∑ - p(i)^2
Gini Index = 1-.6^2

Gini Index = .64

Now, suppose we ask the birthday question, and 30 brown-haired individuals and 20 blonde-haired individuals answer "yes." Since we want to maximize the information gain, we want a drop in entropy after splitting. Written mathematically,

$$\text{Information Gained} = \text{Gini(Parent)} - \sum w_i \text{Gini}(\text{Child}_i)$$

Information Gained = .64 - (50/100).64 - (50/100).64 = 0

As expected, we gained no information from asking this question because choosing a brown-haired individual whose birthday is before June 30th is the same as the probability of the root node. Therefore, the decision tree algorithm will run through every possible option in the data and find a split to maximize the information gained.