

A New Lease on Life in Public Housing: Assessing the Impact of the Rental Assistance Demonstration Program on Smoking in Buildings and Resident Satisfaction

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Abstract

Approximately 28 million U.S. residents in multi-unit housing experience frequent secondhand smoke exposure despite having smoke-free home rules in their individual units. People living in low-income residential settings have among the highest rates of smoking and secondhand smoke exposure. Nationally, public housing has been at the forefront of the smoke-free housing policy movement. In 2018, all public housing sites became subject to a federal ban on indoor smoking so as to reduce smoking-related hazards in properties owned and operated by the U.S. Department of Housing and Urban Development (HUD). At the same time, public housing authorities nationwide have increasingly implemented the Rental Assistance Demonstration (RAD) program to address outstanding capital needs in public housing. The present study is unique in that it examines indoor smoking behaviors, exposure to secondhand smoke, and residential satisfaction in the context of HUD's smoking ban and the RAD program. This study is the first known study to assess indoor smoking and secondhand exposure before and after the construction phases of the RAD conversion. The authors' findings indicate a significant reduction in secondhand smoke exposure and improvements in individual smoking behaviors, which included reduced daily smoking, less indoor smoking, and some successful quit attempts between baseline and followup assessment periods. Furthermore, respondents were significantly more satisfied with their housing units and building conditions, except those who remained bothered by secondhand smoke. The latter result suggests that secondhand smoke exposure may detract from satisfaction with housing improvements and marks a critical opportunity for continued efforts at addressing quality of life concerns. The discussion focuses on strategies used to improve housing conditions and ways in which that may have impacted study results.

Introduction

Over the past 50 years, growing evidence on the adverse health effects of smoking has led to the adoption of policies to reduce risks associated with tobacco smoke. Research indicates that smoking is associated with several diseases, including asthma for smokers and those exposed to secondhand smoke (Stapleton et al., 2011). Mounting evidence on the adverse health effects related to secondhand smoke led to measures designed to reduce environmental tobacco smoke. Primarily these have focused on smoking bans in the public domain (Stein et al., 2015). Beginning in the 1970s, a series of policies resulted in restricting smoking in workplaces, airplanes, buses, trains, hospitals, restaurants, and bars. Widespread smoking restrictions have been slowly adopted in the housing sector. These policies in the housing sector are critical, given the fact that homes and residential settings remain a primary source of exposure to secondhand smoke, particularly for low-income multifamily dwellers and minority groups (Homa et al.; 2015 Klepeis et al., 2001).

In a key study on secondhand smoke in public housing, Kraev et al. (2009) found that 89 percent of non-smoking households were exposed to secondhand smoke that was the equivalent of involuntary smoking activity that was as high as one cigarette per day. Comparable secondhand smoke exposures have also been found in other studies of non-smoking multiple-unit housing residences, where adults and children were shown to have elevated cotinine levels—a biomarker of secondhand smoke exposure—compared with other non-smokers living in detached homes (Klein, Liu, and

Conrey, 2013; Zhang, Martinez-Donate, and Jones, 2015). Previous studies have also examined secondhand smoke exposure in multiple unit housing using biomarkers such as cotinine levels. Wilson et al. (2010) found that 85 percent of children living in apartments in which no one in the household smoked inside “had a cotinine level that indicated recent tobacco-smoke exposure.” The study suggested that a possible cause for this finding was seepage through ventilation systems or walls from neighboring apartments where smoking took place (Wilson et al., 2010). Authors of these key studies all conclude that smoke-free housing policies would effectively reduce secondhand smoke exposure (King et al., 2011; Klein, Liu, and Conrey, 2013; Kraev et al., 2009; Wilson et al., 2010; Zhang, Martinez-Donate, and Jones, 2015).

Disadvantaged populations (i.e., racial/ethnic minority groups, immigrants, the elderly, and those with low education levels and of low socioeconomic status) are also more likely to live in multi-unit housing and are also the least likely to have access to smoke-free home environments (Brown et al., 2015; Helms, King, and Ashley, 2017; Homa et al., 2015; Schoenmarklin and Tobacco Control Legal Consortium, 2010). Approximately 28 million U.S. residents in multi-unit housing experience frequent secondhand smoke exposure despite having smoke-free home rules (King et al., 2010). According to the New York State Department of Health (2016), “Over a million children in NYS are exposed to secondhand smoke in their own homes every year.” People living in low-income residential settings have among the highest rates of smoking and secondhand smoke exposure (Chambers, Sung, and Max, 2015; EPA, 2016; Kingsbury and Reckinger, 2016). For instance, adults receiving federal housing assistance have more than double the smoking rates than the U.S. general population—34 percent versus 15 percent, respectively (Helms, King, and Ashley, 2017). Furthermore, significantly higher concentrations of tobacco retail point-of-sale outlets render residents in low-resource neighborhoods more susceptible to tobacco products, smoking, and secondhand smoke exposure (Lee et al., 2015; Ribisl et al., 2017).

Tobacco use remains a top cause of preventable death in the United States (Ahmed et al., 2014). Yet, tobacco-related health disparities most adversely affect racial/ethnic minorities, those with a high school education or less, and those living at or below the poverty line in underserved communities (Ahmed et al., 2014; Margerison-Zilko and Cubbin, 2012). Smoking is closely tied to asthma, chronic obstructive pulmonary disease, lung cancer, diabetes, and heart disease and affects conditions such as HIV and low birth weight (HHS, 2014). These adverse health conditions are especially pronounced among public housing residents nationally and in New York City, home of the largest public housing authority in the United States. For example, New York City Housing Authority (NYCHA) residents smoke at higher rates (Feinberg et al., 2017). They report higher secondhand smoke exposure from a source outside of their apartments (Farley et al., 2016) and have among the highest number of tobacco retail outlets near them compared with New Yorkers overall (Rogers and Vargas, 2017).

Smoke-Free Housing Policy and Administrative Shifts Within the Public Housing Sector

Nationally, public housing has been at the forefront of the smoke-free housing policy movement. Adoption of smoke-free housing policies increased markedly from 17 housing authorities in 6 states in 2005 to 141 housing authorities in 20 states in 2010 (Winickoff, Gottlieb, and Mello, 2010). In 2016, a federal-level mandate instituted a system-wide smoking ban in public housing,

a measure affecting 3,300 housing authorities and 1.2 million households nationwide as of August 2018 (HUD, 2016). NYCHA is the largest public housing provider in the nation; it houses more than 400,000 people in 326 public housing developments spanning over 2,400 buildings citywide (NYCHA, 2017). In July 2018, all NYCHA housing units adopted a smoke-free policy. In New York City, smoking in common areas (such as hallways, stairwells, lobbies, and elevators) of multi-family residential buildings was banned in 2010. Furthermore, as of August 2018, all buildings with three units or more were also required to have a stated smoke-free policy under NYC Local Law 2017/147. Therefore, the new smoke-free housing policy banned smoking inside apartment units and within 25 feet of the building perimeter. The implementation of this policy, the largest of its kind, represents a critical opportunity to examine and reduce public housing-related tobacco hazards.

At the same time, public housing has been undergoing administrative transitions to address a documented \$32 billion capital backlog at NYCHA (more than \$50 billion nationwide) that threatens to reduce the public housing inventory and also poses health and quality of life challenges for residents (NLIHC, 2019). The Rental Assistance Demonstration (RAD) program is the latest HUD-sponsored initiative to preserve public housing while addressing the ill effects of deferred maintenance (NLIHC, 2019). In essence, RAD converts Section 9 public housing and certain other subsidized housing developments (Rent Supplement, Rental Assistance Payment, Section 8 Moderate Rehabilitation, and Moderate Rehab Single Room Occupancy) to long-term Section 8 rental assistance contracts. This conversion allows public housing agencies to tap into private funding sources not available under Section 9 (e.g., affordable housing developers), which can finance necessary upgrades, repairs, and ongoing maintenance. RAD's main goals are to improve and preserve affordable housing while also improving resident outcomes by way of capital improvements. As of 2018, \$12.6 billion in funding—both private and public—has been leveraged through RAD to improve 103,268 affordable housing units dispersed across 956 public housing projects at an average rate of \$121,747 per unit (Econometrica and Urban Institute, 2019). Beyond HUD-commissioned interim and final program evaluations, research examining the effects of the RAD program is limited, especially site-specific research with a diverse set of outcomes.

New York City has been a relatively late adopter of the RAD program. NYC first implemented RAD in 2016 at Ocean Bay, a Hurricane Sandy-affected NYCHA development that has since undergone significant renovations. A preliminary assessment of the RAD conversion process at Ocean Bay that Enterprise Community Partners conducted indicated key lessons learned at the various stages from planning to service delivery within the site. Some salient themes included in their report were the importance of early resident engagement, anticipating varied experiences with the physical improvements, and greater clarity about what the RAD conversion process entails, particularly from the resident perspective (Enterprise Communities, 2019). However, the data were limited to focus groups with a small number of residents and interviews with resident leaders and the development and property management teams.

The Ocean Bay developers on the RAD deal—Wavecrest Property Management Team, LLC (Wavecrest) and MDG Design + Construction, LLC (MDG)—also led the second RAD conversion in NYC at Betances Houses, a scattered site development in the South Bronx. They finalized the administrative transfer at Betances in November 2018, having assumed partial ownership of

the site alongside NYCHA. Shortly thereafter, the developers implemented major renovations, including upgraded bathrooms, kitchens, floors, mold and lead abatement, pest control, the installation of energy-efficient windows and heating equipment, and exterior repairs; these changes included added security measures at each of these developments without requiring residents to relocate. Prior to implementing these upgrades, the developers met with residents to explain the changes, the timeline, and respond to questions and concerns.

Betances Houses is comprised of 1,088 units in 48 non-contiguous buildings of varying size that house approximately 4,000 residents. The buildings are scattered within about a half-mile radius of each other throughout the Mott Haven section of the South Bronx. Through RAD, Betances underwent an administrative shift to unlock financing mechanisms to address the capital needs of the buildings, and residents continue to benefit from an income-based rent of approximately 30 percent of household income. Specifically, the Betances site transitioned from Section 9 (traditional public housing units) to Section 8 (project-based, meaning that the subsidy is tied to the buildings/units) and Section 18, allowing for the disposition or demolition of properties that meet certain criteria with HUD approval. Of note, RAD residents would become eligible for Housing Choice Vouchers issued directly to leaseholders upon living in the improved unit for at least 12 months.

Already subject to NYCHA's smoking ban, Wavcrest opted to maintain the policy and keep the buildings completely smoke-free, meaning that residents were not allowed to smoke in their units or in common areas. For over a decade, smoking has been banned in common areas in all buildings in NYC with 10 units or more. Furthermore, all buildings in NYC with three units or more were also required to have a stated smoke-free policy as of August 2018 under NYC Local Law 2017/147. This policy directly overlapped with the public housing smoking ban affecting all buildings in New York City, thereby supporting and solidifying a local emphasis on smoke-free buildings. Historically, however, challenges with smoke-free housing compliance and enforcement have undermined policy effectiveness (Hernández et al., 2019b). Furthermore, maintenance defects, tensions with property management, and unaddressed repair needs also served to compromise adherence to smoke-free housing policies (Hernández et al., 2019b). The present study allowed us to test the impacts of physical improvements in the housing realm to determine associations with the goals of the smoke-free housing policy and resident satisfaction.

Evaluating Indoor Smoking and Secondhand Smoke Exposure in the Context of RAD

The present study is unique in that it examines indoor smoking behaviors, exposure to secondhand smoke, and residential satisfaction in the context of RAD and the smoking ban. This is the first known study to objectively assess smoking-related outcomes along with residential satisfaction before and after the RAD conversion process, including a substantial renovation phase. Rather than focusing solely on the smoke-free policy implementation, this study seeks to determine if additional interventions geared toward improving housing conditions serve the mutual benefit of supporting smoke-free housing measures.

Data collection for this project was initiated in January 2019, shortly after the RAD conversion but just before major renovations within the units and approximately 6 months after implementation of the stated smoke-free policy. At followup, starting in January 2020, the renovations in units

and throughout the buildings were largely completed. The authors' primary research question was, *how does the RAD conversion process, especially the capital improvements in buildings and units, impact adherence with the smoke-free housing policy at Betances Houses?* They hypothesized that substantial improvements in the physical conditions of housing would reduce indoor smoking because residents would (a) feel less stressed and more satisfied with their housing in the absence of ongoing maintenance issues; (b) have a greater sense of pride in their home environment and work to preserve the “newness” of their place (Hernández et al., 2019a); and (c) the upgrades would represent an investment on the part of property management strengthening the social contract between the housing owner/operator and tenants (Hernández et al., 2019b). In this article, the authors report their findings across each of these domains, emphasizing the results of this first-in-kind evaluation of secondhand smoke exposure, resident smoking behaviors, and residential satisfaction in the context of two overlapping housing policies—RAD and smoke-free housing policy.

Data Collection and Methodological Procedures

To assess secondhand smoke exposure, smoking behaviors and beliefs, and the residential experience of tenants in 16 Betances buildings, various forms of data collection were employed: surveys, visual inspections of common areas in the buildings, indoor environmental exposure assessments, and focus groups (only results of the first two data types are reported here). Building selection was made with consideration to size (number of units). Eleven properties, six small (8 units), three medium (51–57 units), and two large (88 and 152 units), were initially selected for inclusion. Due to difficulties recruiting participants, the number of buildings was expanded to 16, which included 5 small (8 units), 7 medium (19–70 units), and 4 large (88–152) properties.

Baseline data collection took place between January and April 2019 with the help of Columbia University graduate and undergraduate research assistants who administered household surveys and conducted exposure assessments. Team members were always paired when doing door-to-door recruitment or collecting data during daytime hours and on weekends. Research assistants also recruited residents from the primary management office, where residents would pay their rent, report issues, or otherwise speak to management staff in person. Participation in the survey was open to one adult (18 years of age or older) per household, and research assistants requested that the head of household take the survey. Participants were given a \$10 gift certificate for each study component at both baseline and followup. Followup assessments occurred from January 2020 to March 2020. During followup visits, the same household member who was interviewed during the baseline was asked to participate again. Due to the coronavirus pandemic, data collection was abruptly halted prior to reaching the authors' participant followup goals for the survey and especially the exposure assessments. The authors report here their loss to followup rate and recognize the limitations that the small sample size presents. Despite this, their results highlight important trends and significant findings across a number of domains.

As a team, the investigators, housing providers, and the HUD program officer collaboratively established a set of goals relevant to this layered policy intervention based on existing literature and previously established thresholds across three domains: (1) smoke-free housing compliance and

enforcement; (2) resident smoking behaviors and health outcomes; and (3) resident engagement and housing satisfaction. First, regarding policy compliance and enforcement, the authors measured indoor smoking by self-report and environmental exposures (Kennedy et al., 2015), self-reported secondhand smoke exposure and smoking outdoors (Kingsbury and Reckinger, 2016), and improvements in knowledge and support of the smoke-free policy (Hood et al., 2012). Second, related to resident smoking behaviors and health, the authors asked respondents about smoking frequency and subsequently calculated cost savings from smoking less along with quit attempts for those who smoked. The authors also asked participants about respiratory health symptoms, emergency room visits, and hospitalizations (Kingsbury and Reckinger, 2016). Third, as it pertained to resident engagement and satisfaction, they sought to capture changes in levels of participation in resident-centered groups and activities (Baezconde-Garbanati et al., 2011) and residential satisfaction overall and in terms of unit and building maintenance (Hernández et al., 2019b; Rokicki et al., 2015). Specific to compliance with the policy, the authors asked about indoor smoking activity by anyone in the household, including visitors. The following provides further details on the authors' measures.

Measures

Smoking and Secondhand Smoke Exposure Measures: To gauge if a respondent smoked or used another inhaled product, all interviewees were asked at baseline and followup whether they currently used any of the following products: cigarettes, cigarillos, e-cigarettes, marijuana, hash, THC, grass, pot, weed, or hookah, with a final option of “don't smoke.” Respondents who selected “don't smoke” at both time periods were considered to be non-smokers, while those who indicated current use of at least one product at either baseline or followup were coded as smokers. Smoking, by product type and frequency, was also captured at the household level. A household included a smoker if the respondent, another household member, or a visitor smoked. Data on the smoking behavior of all residents of the selected buildings were not available, so building smoking rates were approximated. The proportion of smoking households out of those interviewed was recorded for all buildings with 5 or more participants (7 buildings out of the 16 sampled met this criterion at both baseline and followup).

Smoking cessation efforts were noted for any respondent who reported stopping smoking a tobacco product for at least 1 day within the past year in an attempt to quit smoking. Respondents did not need to self-identify as smokers to report a quit attempt.

Indoor smoking was recorded for those households in which a member or visitor was reported to smoke in the apartment or if the respondents themselves were smokers and affirmed that over the course of the workweek or weekend, they did not go outside at all. Outdoor smoking data were collected by asking respondents where they noticed smoking most frequently. All those who indicated outdoors or described a location outside of their building or development were coded as observing outdoor smoking.

Secondhand smoke exposure was assessed by asking respondents if, within the past year, they noticed smoke that entered their apartments from elsewhere in or around the building, noting the

frequency of exposure (daily, weekly, monthly, a few times within the past year, and never) and type of smoke (tobacco or marijuana).

Smoke-Free Policy Knowledge and Support Measures: Respondents' knowledge of the smoke-free housing policy (SFHP) was first assessed by asking if they lived in a "smoke-free" building. Understanding of the policy was determined from respondents' selection of what they considered their building smoking policy to be: (1) Smoking is allowed anywhere in the building; (2) Smoking is prohibited in public areas, but allowed in apartments; (3) Smoking is prohibited in all areas of the apartment building, including inside apartment units; or (4) Other, enabling the respondent to describe the policy as they understood it. The third option accurately reflects the SFHP governing all Betances buildings. Support for the SFHP was captured after informing respondents that all Betances properties have a smoke-free policy and asking for their opinion on this. Supportive responses included those in which the respondent stated they liked the policy, thought it was an okay or good policy, and/or agreed with the policy, etc. Lack of support was noted for those who explicitly disagreed with the policy, disliked it, or asserted that smoking should be allowed. Knowledge of and support for the SFHP was a composite measure, indicative that the respondent knew their building was smoke-free, could properly define the policy, and supported it.

Resident Engagement Measures: Resident engagement was measured through group involvement and respondents' perceived connections with their community. Participation in building tenants' associations was recorded, as was group membership in organizations such as faith-based institutions and cultural, social, civic, sports, and health groups, etc., within the past 6 months. Respondents were also asked for their reaction to statements about their community, ranging from strongly disagree to strongly agree. Community enjoyment was captured through agreements with the phrase, "I like where I'm living now," while connectivity was noted by those affirming, "There are people that I feel close to in this community."

Satisfaction Measures: Participants were asked to rate their satisfaction with their apartment, building, neighborhood, and property management on a four-point Likert scale, from very dissatisfied to very satisfied. Resident housing satisfaction (unit) indicates those respondents who were satisfied or very satisfied with their unit, whereas resident housing satisfaction (unit and building) includes those respondents who were satisfied or very satisfied with both their unit and their building. Satisfaction with maintenance refers to those respondents who were satisfied or very satisfied with the property management. General satisfaction is a composite score, calculated by summing resident satisfaction with their apartment, building, neighbor, and property management.

To identify measures associated with improvements in resident satisfaction, baseline and followup satisfaction levels were compared and then dichotomized to highlight three different types of change: any increase in satisfaction, an increase from dissatisfied to satisfied, and an increase to very satisfied. Any increase in satisfaction encompasses those whose satisfaction with the measure of interest (general, unit, unit and building, or property management) increased from baseline to followup, regardless of the magnitude of that change. For the two composite measures, general and housing (unit and building), any increased satisfaction was determined by first summing the respondents' scores, then comparing whether the total score increased from baseline to followup. Change in satisfaction from dissatisfied to satisfied includes those respondents who were either

dissatisfied or very dissatisfied with the measure of interest at baseline and changed their opinion to either satisfied or very satisfied at followup. Change in satisfaction to very satisfied refers to those who became very satisfied with the measure of interest by followup.

Housing Condition Measures: Poor housing conditions were documented by respondent observations of pests such as mice and rats or the odor of mildew. Respondents were also asked if anything within their apartment or building negatively impacted their health.

Statistical Procedures

Baseline and followup response percentages are reported for each outcome, with progress against project targets given in percent changes. Project targets were informed by results of findings from previous studies and selected in consultation with HUD and the implementing partner.¹ Unless otherwise noted, McNemar's test was used to evaluate differences between baseline and followup, and the phi coefficient is listed for effect size. The phi coefficient, also known as Cramer's phi, (ϕ) ranges from zero to one; $\phi \leq 0.2$ denotes a small effect, $0.2 < \phi \leq 0.6$ a medium effect, and $0.6 < \phi$ a large effect (Rea and Parker, 1992). Predictors of improved residential satisfaction are then identified through multivariable logistic regression. Logistic regression was first used to identify all variables associated with the outcome of interest. These variables, and the select variables hypothesized to have an effect on the outcome of interest, were then added sequentially into models controlling for respondent and household characteristics. Covariates included gender, ethnicity, the highest level of education, the presence of a vulnerable person in the household,² the number of years lived in one's apartment, and whether needed repairs were completed. All analyses were performed in Stata 16 (StataCorp LLC, 2019), and a p-value of less than 0.05 was considered significant.

Results

Sample Characteristics

From January through April 2019, 124 baseline interviews were conducted with Betances residents. Followup interviews were held a year later, from January through March 2020, with 83 households. Of these, 80 participated in both survey rounds for a 65-percent followup rate. No significant differences were found in demographic, socioeconomic, or household composition characteristics between the baseline and final samples.

Most respondents in the final sample (n=80) were female, and more than two-thirds identified as Hispanic or Latino. More than three-fourths of the sample were more than 40 years old, and almost one-half of respondents had less than a high school education. Respondents who listed disability, public assistance, welfare, or HIV/AIDS Services (HASA) were all considered to be receiving Social Security. Social Security was the most common primary source of income during both interview rounds. Few respondents reported earning more than \$25,000 a year, and more than one-half

¹ Project targets are rated as Achieved, Partially Achieved, or Not Achieved. Partially Achieved indicates changes that demonstrated progress (e.g., a behavior decreased as intended), but did not meet the stated percent change, while Not Achieved indicates no change or a change in the opposite direction of the intended effect.

² A household is considered to be vulnerable if the members include a child under the age of 18, an adult aged 55 or older, or someone with a respiratory illness.

were rent-burdened. A respondent was considered to be rent-burdened if the portion of rent which they paid was or exceeded 30 percent of their mean reported income level (PD&R Edge, n.d.). Respondents were given a card with 10 income levels to use to report their income, while rental totals were recounted directly. As such, the stated rent burden may not accurately reflect participants’ financial conditions. A selection of sample characteristics is available in exhibit 1.

Exhibit 1

Baseline and Final Sample Characteristics					
Respondent Characteristics		Baseline Sample (n=124)		Final Sample (n=80)	
		n	%	n	%
Gender	Female	97	78	66	83
	Male	26	21	14	18
	Other	1	1	0	0
Race/ Ethnicity	Non- Hispanic Black or African American	26	21	19	24
	Hispanic or Latino	87	70	54	68
	Bi/Multiracial	3	2	4	5
	Other	8	6	3	1
Age Group	18-24 years old	7	6%	2	3
	25-40 years old	22	18	13	16
	41-64 years old	49	40	34	43
	65+ years old	44	36	30	38
Highest Education Level Group	Less than High School	54	44	42	53
	High School or Equivalent	46	37	25	31
	More than High School	23	19	13	16
Employment Group	Employed Full-Time	22	18	10	13
	Employed Part-Time ^a	15	12	5	6
	Unemployed ^b	15	12	8	10
	Out of Labor Force ^c	71	58	57	71
Years in Apartment	Mean (Std. Dev.)	15 (12)		16 (11)	
Household Occupancy ^d	Mean (Std. Dev.)	3 (1.8)		2 (1.8)	
Household has Child Under 18	Yes	43	35	22	28
Household has Adult Over 55	Yes	40	32	18	23
Household has Member with Respiratory Illness	Yes	63	51	38	48

^aPart-time employment includes part-time and self-employed because all self-employed respondents’ incomes were low.

^bUnemployed refers to those out of work but looking for work and students.

^cOut of labor force includes those out of work and not looking for work, homemakers, and retirees.

^dNumber of household residents.

Note: Percentages may not add up to 100 percent due to rounding.

Source: Authors’ analysis

Smoke-Free Housing Policy Compliance and Enforcement Goals

Nearly all smoke-free housing policy (SFHP) compliance and enforcement goals were achieved (exhibit 2). Five of the 27 smoking households stopped smoking indoors over the project period, a 21-percent reduction; of these, three quit smoking entirely. Although this difference is insignificant, the estimated effect size of this change is moderate.

Indoor secondhand smoke exposure, defined as any type of smoke (tobacco or marijuana) noticed at any time within the past year, declined 18 percent from baseline to followup among all respondents. When limiting this difference to just non-smoking households, the reduction across the project period was 22 percent. Both differences were significant and of moderate effect size.

When describing their secondhand smoke exposure, respondents selected from the following frequencies: noticing secondhand smoke not at all, just a few times a year, monthly, weekly, and daily. The percentage of respondents who indicated each of these levels as the highest frequency of secondhand smoke observed, regardless of product (tobacco or marijuana), is presented in exhibit 3 for baseline and followup. The greatest increase—83 percent, which was also a significant change of medium effect size—was for those respondents who reported no secondhand smoke within the past year. Also significant was the decline in the percentage of respondents who reported experiencing secondhand smoke daily; the reduction of 29 percent was a moderate effect.

Exhibit 2

SFHP Compliance and Enforcement Goals

Outcome	Target (%)	Status	Baseline (%)	Followup (%)	n	Percentage Change	p-value	Effect Size
Reduction in indoor smoking ^a	15	Achieved	56	44	27	21% decrease	0.453	0.22
Reduction in indoor secondhand smoke (SHS) exposure, all households ^b	15	Achieved	83	68	80	18% decrease	0.008**	0.32
Reduction in indoor SHS exposure, non-smoking households	15	Achieved	87	68	53	22% decrease	0.013*	0.38
Increase in smoking outdoors or in designated smoking areas ^c	15	Achieved	39	61	79	56% increase	0.008**	0.30
Increase in SFHP knowledge and support ^{d,e}	20	Not Achieved	42	36	73	14% decrease	0.297	0.12
Knows building has SFHP			61	63	80	3% increase	0.842	0.02
Describes SFHP correctly			63	60	80	5% decrease	0.683	0.05
Supports SFHP ^e			73	81	73	11% increase	0.267	0.16
Increase in SFHP enforcement activities	50	NA	NA	NA	--	--	--	--

^aIndicates $p < 0.05$; ^{**}Indicates $p < 0.01$; ^{***}Indicates $p < 0.001$.

^bPercentage of households with an indoor smoker out of all smoking households (27 households had a smoking member at least one time point).

^cSHS exposure of any type (tobacco or marijuana), any frequency, observed within the past year as reported by the respondent. Percent changes of SHS exposure by frequency are also reported for comparison in exhibit 3.

^dSmoking outdoors as observed by the respondent.

^eKnowledge of and support for the SFHP is a composite measure indicating respondents know of, can properly define, and support the SFHP.

^fThe sample sizes of the selected indicators are less than the total n due to missing responses at either time point.

NA = data not available. SFHP = smoke-free housing policy.

Source: Authors' analysis

An additional indicator—“increase in SFHP enforcement activities by 50 percent”—was included under the SFHP compliance and enforcement goals. Enforcement activities compose the presence of SFHP signage on Betances properties, lease counseling to familiarize tenants with the policy, reminders of the smoke-free policy on the monthly rent slips, and warning letters and citations to residents when a violation of the policy is observed. This indicator was not evaluated because data on these activities were not received from the implementing partner.

Exhibit 3

Indoor Secondhand Smoke Exposure Among All Respondents

Secondhand Smoke (SHS) Exposure (Past Year)	Baseline (%)	Followup (%)	n	Percentage Change	p-value	Effect Size
Never Experienced SHS	18	33	80	83% increase	0.008**	0.32
Experienced SHS a Few Times	9	16	80	77% increase ^a	0.238	0.16
Experienced SHS Monthly	3	1	80	66% decrease	1.000	0.06
Experienced SHS Weekly	16	11	80	31% decrease ^a	0.481	0.11
Experienced SHS Daily	55	39	80	29% decrease	0.020*	0.26

*Indicates $p < 0.05$; **Indicates $p < 0.01$; ***Indicates $p < 0.001$.

^aThe increases in SHS exposure a few times a year is a positive result stemming from the reduction of SHS exposure at higher frequencies.

Source: Authors' analysis

Forty percent of respondents experienced some reduction in the amount of secondhand smoke they were exposed to from baseline to followup. The most substantial decline in secondhand smoke exposure—from observing secondhand smoke daily to not at all—was also the most common individual change, reported by 11 percent of respondents. Forty-five percent of respondents reported no change in secondhand smoke levels.

Outdoor smoking, as observed by participants, increased by 56 percent across the project period. This rise was a significant change with a medium effect size.

The goal of increasing SFHP knowledge and support was not achieved. Improvements were observed in knowledge of and support for the policy, but not in correctly describing the policy. Awareness of and support for the SFHP increased slightly from baseline to followup. Although the percentage of respondents who correctly identified what the SFHP entailed declined across the project period, respondents' understanding that the SFHP was less permissible of widespread smoking had increased at followup. Eight respondents understood the smoking policy as allowing for smoking in any location in the building at baseline. At followup, only one still held this understanding, whereas the remaining seven either became more aware in their understanding of the strictness of the policy (n=4) or were no longer sure of its definition (n=3).

Resident Smoking Behaviors and Health

Most smoking behavior and health goals were partially achieved (exhibit 4). Baseline and followup building smoking rates were averaged across those buildings with at least five participants. The same seven locations met this criterion at both baseline and followup, and a slight increase in

average building smoking rate was recorded. Given the small building sample size, this slight change is considered to be negligible.

Exhibit 4

Resident Smoking Behavior and Health Goals								
Outcome	Target (%)	Status	Baseline	Followup	n	Percentage Change	p-value	Effect Size
Reduction in building smoking rate ^a	2	Not Achieved	21%	23%	7	10% increase	0.730 ^b	0.14 ^b
Reduction in smoking frequency ^c	20	Partially Achieved	54%	50%	26	7% decrease	1.000	0.09
Increase in smoking cessation efforts	10	Not Achieved	19%	19%	80	no change	1.000	0.00
Increase in cost savings from reduced smoking ^d	20	Partially Achieved	\$34	\$28	20	18% decrease	0.165 ^e	0.32 ^e
Improve asthma-related health								
Reduction in household members with asthma symptoms ^f	20	Partially Achieved	47%	43%	79	9% decrease	0.508	0.11
Reduction in households with asthma ER visits ^f	20	Partially Achieved	11%	10%	79	9% decrease	1.00	0.05
Reduction in households with asthma hospitalizations ^f	20	Achieved	4%	1%	79	75% decrease	0.625	0.11

^aSmoking rate was approximated by averaging the percentage of smoking households out of all interviewed households in buildings with at least five participants. The same seven buildings met this criterion at both baseline and followup.

^bA paired t-test was used to test the difference between the mean percentage of smokers per building with more than five respondents at baseline and followup. Effect size was calculated with Cohen's *d*.

^cThe most common smoking frequency, of any product, at both baseline and followup was more than one product daily, which is the frequency reported for this indicator (percentage of smoking households that smoke at the selected frequency out of all smoking households, *n*=26 because one smoking household did not share any details about how often they smoked). Changes in lower frequencies are also presented in exhibit 5 for comparison.

^dAverage estimated weekly expenditure on cigarettes by smoking respondents (number of tobacco or marijuana products smoked per week was only collected from respondents who smoked and was unavailable for those smoking households in which the smoker was not also the interviewee). Cost was calculated according to the NYC minimum price per pack, \$13 (NYC Department of Health and Mental Hygiene, 2018). Those who smoked cigarettes at one time period but not the other have an expenditure of zero for the non-cigarette smoking period. Figures may be an underestimate, as those who smoked less than one-half a pack per week were round down to zero.

^eA paired t-test was used to compare the average weekly cost of cigarettes between baseline and followup, while Cohen's *d* was used to determine the effect size.

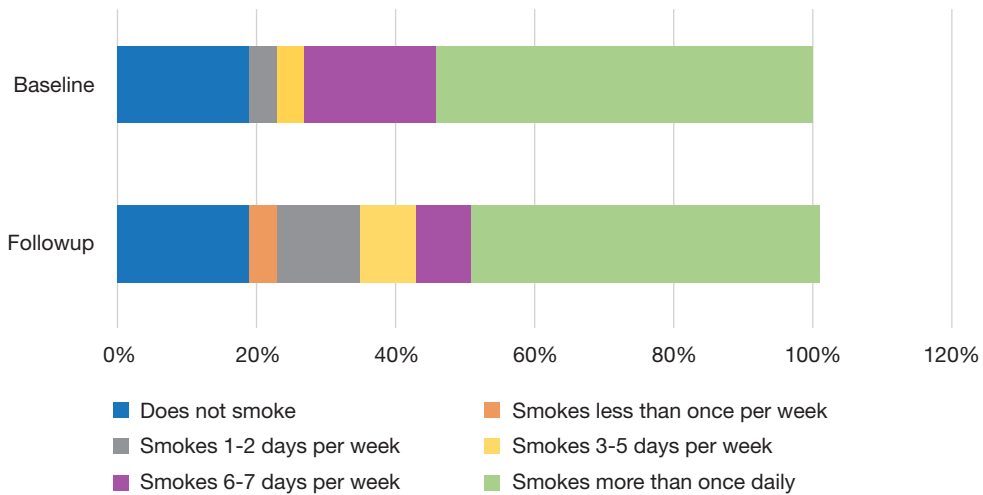
^fThe sample sizes of the selected indicators are less than the total *n* due to missing responses.

Source: Authors' analysis

The most common smoking frequency at baseline and followup was smoking more than one product (tobacco or marijuana) daily; the percentage of respondents who indicated this frequency declined. Although this demonstrates a positive change, it is not of practical significance given the small number of smokers. A larger reduction was observed among those who smoked 6–7 days per week (exhibit 5). Neither of these changes was significant.

Exhibit 5

Smoking Frequency at Baseline and Followup



Source: Authors' analysis

In total, 31 percent (n=8) of smoking households that reported their smoking frequency reduced how often they smoked from baseline to followup. Of those who reduced their smoking, one-half (n=4) quit entirely. Fifty percent (n=13) of these households did not change the frequency with which they smoked; 42 percent (n=11) consistently smoked more than once daily, whereas 8 percent (n=2) smoked 6–7 days per week. Exact changes are recorded in exhibit 6.

Exhibit 6

Individual Changes in Smoking Frequency

Weekly Smoking Frequency, One Product, Any Type	Followup						
	Baseline	Never ^a	Less than once per week	1–2 days per week	3–5 days per week	6–7 days per week	More than once daily
Never ^a		0	2	1	0	0	2
Less than once per week		0	0	0	0	0	0
1–2 days per week		1	0	0	0	0	0
3–5 days per week		0	0	1	0	0	0
6–7 days per week		1	0	1	1	2	0
More than once daily		2	0	0	1	0	11

Values along the diagonal represent participants who did not change their smoking frequency. Values above the diagonal (shaded in red in the upper right diagonal) indicate an increase in smoking frequency, while those below the diagonal (shaded in green in the lower right diagonal) are reductions.

^aValues in the Never row reflect the households that went from non-smoking to smoking over the project period, while those in the Never column reflect smokers who quit by followup.

Source: Authors' analysis

Although no overall percentage change was recorded between baseline and followup cessation attempts, four respondents no longer identified as smokers at the project conclusion. An additional three participants reported an attempt to quit but did not identify a smoker in the household at either baseline or followup, suggesting they commenced and ceased smoking outside of the project's data collection periods.

The target change in cost savings due to a reduction in smoking was nearly achieved. Although this difference was insignificant, the magnitude of the estimated effect was moderate. Savings were estimated by converting the reported number of cigarettes smoked per day to a weekly measure and then multiplying these figures by the minimum price per pack in New York City, \$13 (NYC DOHMH, 2018). The weekly expenses for those respondents who smoked less than one-half of a pack per week were rounded down to zero. As such, these figures may be an underestimate of smoking expenditures and savings.

All three asthma-related measures slightly declined from baseline to followup, but each of these changes were insignificant with a small estimated effect size.

Resident Engagement and Housing Satisfaction

All resident engagement and housing satisfaction goals were partially or fully achieved (exhibit 7). Resident engagement nearly doubled from baseline to followup. However, this increase was neither significant nor a sizable effect.

Exhibit 7

Resident Engagement and Housing Satisfaction Goals

Outcome	Target (%)	Status	Baseline (%)	Followup (%)	n	Percentage Change	p-value	Effect Size
Increase in resident engagement (as indicated by participation in tenant associations)	20	Achieved	5	9	79	80% increase	0.549	0.10
Increase in housing satisfaction ^a								
Satisfaction with unit	20	Achieved	71	93	80	31% increase	0.000***	0.44
Satisfaction with unit and building	20	Achieved	48	83	80	73% increase	0.000***	0.59
Increase in maintenance satisfaction ^b								
Satisfaction with property management among households needing maintenance	20	Partially Achieved	74	83	72	12% increase	0.210	0.17
Satisfaction with property management among households that received maintenance	20	Partially Achieved	82	90	49	10% increase	0.424	0.15

^{*}Indicates $p < 0.05$; ^{**}Indicates $p < 0.01$; ^{***}Indicates $p < 0.001$.

^aHousing satisfaction was measured twice. The first gauges resident satisfaction with just their unit; the second captures satisfaction with their unit and building.

^bMaintenance satisfaction was calculated twice. Satisfaction with property management among households in need of repairs is first presented, followed by satisfaction among those households that received repairs.

Source: Authors' analysis

Housing satisfaction, both with the unit and with the unit and building, improved significantly from baseline to followup. Both changes had a medium effect size. Several residents, whose satisfaction with their housing during the project period improved, specified changes made to their units when asked what they liked best about where they lived. These sentiments were captured in the following quotes extracted from select recorded interviews: “It’s gotten a lot better, I feel like I’m in a new apartment.” “My apartment, they just remodeled.” “They fix everything; everything is good.” “Everything, they renewed everything.” “Renovated, comfortable.”

The percentage of respondents satisfied with management, both those needing and receiving repairs, increased from baseline to followup. This improvement, however, was not significant and had a small estimated effect size. One respondent who was more satisfied with management at followup remarked, “things [are] a lot better with the new management” and added that they don’t “see much smoking with the new management.” Another whose satisfaction with their unit increased still expressed reservations about the scheduling of repairs, noting, “It’s okay, management takes forever to fix [things].” For those whose satisfaction with management declined from baseline to followup, respondents voiced concerns about failure to give notices about the renovations and wait times for repairs.

Predicting Change in Residential Satisfaction

Improvements in residential satisfaction, general and specific to housing and maintenance, were modeled to identify measures associated with a positive change in resident opinions. Improved satisfaction of any magnitude was reviewed for each type of residential satisfaction (general, unit, unit and building, and property management), whereas changing from dissatisfied to satisfied and changing to very satisfied were limited to the housing and maintenance measures. Only those models with significant predictors are presented here. Each model has been adjusted for individual characteristics (gender, ethnicity, the highest level of education, the presence of a vulnerable person in the household,³ the number of years lived in one’s apartment, and whether repairs were completed for that apartment).⁴ Exhibits 8 and 9 report the coefficients in odds ratios alongside their confidence intervals. Confidence intervals that exclude one demonstrate a significant association with the outcome of interest.

General satisfaction, taking into consideration the respondent’s opinion of their unit, building, neighborhood, and the property management, changed from baseline to followup for more than three-fourths of participants (n=56; 76 percent).⁵ Respondents whose requested unit repairs were completed, who were bothered by secondhand smoke, or who complained of mice, rats, or mildew in their units were, on average, less likely to have reported increased levels of general satisfaction (exhibit 8). Respondents whose satisfaction did not improve despite repairs to their unit had, on average, a greater number of complaints about pests and mildew relative to those who were more

³ A household is considered to be vulnerable if members include a child under the age of 18, an adult aged 55 or older, or someone with a respiratory illness.

⁴ All covariates are binary with the exception of the number of years lived in one’s apartment. The reference category for each of the binary variables is given in parentheses following the variable name in exhibits 8 and 9.

⁵ Percentages in this section are not derived from the full sample (n=80) when a respondent replied “I don’t know” at either baseline or followup. Only 74 of the 80 participants specified their level of satisfaction for all the measures.

satisfied generally at followup. The difference in mean number of housing problems was not, however, significant between those whose satisfaction did and did not increase.

Thirty-one respondents (39 percent) became more satisfied with their apartments from baseline to followup. Of these, 18 respondents (23 percent) were initially dissatisfied (or very dissatisfied) with their units, but they became satisfied (or very satisfied) by the project end. A critical finding of our analysis was that, net of other factors, smokers had greater odds of becoming more satisfied, by any degree, with their units. Yet, changing one's opinion of their unit, from dissatisfied to satisfied, was less likely for those bothered by secondhand smoke, while feeling close to people in the community was marginally associated with greater odds of this change in satisfaction (exhibit 8). Those who felt that something within their apartment or building made them ill or negatively impacted their health were less likely to become very satisfied with their unit by the followup, after controlling for individual characteristics (exhibit 8). No clear explanation for changes in satisfaction surfaced while exploring additional factors that may have contributed to these findings based on other survey responses and qualitative accounts. These findings merit further attention in future research.

Satisfaction with home and building improved for more than one-half of respondents (n=46; 58 percent) from baseline to followup, and more than one-third (n=28; 35 percent) changed their opinion to view their unit and building positively. Being bothered by secondhand smoke lowered the odds that a respondent's opinion of their unit and building would improve by any margin or from dissatisfied to satisfied (exhibit 9). Those who liked where they lived had greater odds of changing their satisfaction with their unit and building from dissatisfied to satisfied at the followup interview. This change should, however, be interpreted with caution, given its wide confidence interval (exhibit 9).

Increased satisfaction with property management at followup was reported by about one-third of respondents (n=24; 30 percent). Sixteen respondents (20 percent) changed their opinion of property management from negative to positive by followup. Accounting for individual characteristics, only group membership had a significant association with any improvement in satisfaction with property management. Involvement with any type of group (religious, cultural, social, or sporting, etc.) lowered the odds that a respondent's satisfaction with property management improved over the project period. Participants with a high school diploma, its equivalent, or higher educational level and households with a smoker had a greater chance of changing their opinion of property management from dissatisfied to satisfied, net of individual characteristics.

Exhibit 8

Change in Satisfaction, General and Housing (Unit)

	Change in General Satisfaction (Any Increase) n=67			Change in Satisfaction with Unit (Any Increase) n=72			Change in Satisfaction with Unit (Dissatisfied to Satisfied) n=72			Change in Satisfaction with Unit (Increased to Very Satisfied) n=72		
	Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval	
Gender (Male)	0.460	0.097	2.173	0.277	0.057	1.341	0.314	0.041	2.425	0.341	0.065	1.786
Ethnicity (Hispanic)	2.604	0.656	10.335	0.720	0.240	2.163	0.539	0.145	2.007	0.607	0.169	2.184
Highest Education Level												
(High School or higher)	0.899	0.274	2.952	1.223	0.874	1.712	5.915*	1.311	26.683	0.189*	0.049	0.722
Vulnerable Household ^a	5.660	1.174	27.282	1.686	0.472	6.028	2.731	0.494	15.094	1.291	0.326	5.116
Years in Apartment	0.985	0.932	1.041	0.929*	0.871	0.991	0.949	0.889	1.014	0.950	0.893	1.011
Repairs Completed	0.113*	0.020	0.638	1.832	0.555	6.042	1.163	0.286	4.726	2.100	0.531	8.310
Bothered by Second-hand Smoke in Apartment	0.058**	0.008	0.432				0.179*	0.039	0.825			
Respondent is a Smoker				4.144*	1.072	16.017						
Presence of Vermin or Mildew	0.107**	0.021	0.538									
Negative Health Impact from Unit or Building										0.161*	0.036	0.726
Feels Close to Others in Community							5.067	0.993	25.851			
(constant)	54.675	2.665	1121.906	0.824	0.112	6.087	0.230	0.018	3.008	2.402	0.196	29.515
Pseudo R ²	0.201			0.148			0.199			0.164		
AIC ^b	90.160			99.286			82.864			85.468		

*Indicates $p < 0.05$; **Indicates $p < 0.01$.

^aA household is considered to be vulnerable if members include a child under the age of 18, and adult aged 55 or older, or someone with a respiratory illness.

^bThe Akaike's Information Criterion (AIC) is a relative measure of model fit with lower scores reflecting a more appropriate model. A reduction in at least seven points represents a meaningful improvement.

Note: Group in parentheses indicates the reference group.

Source: Authors' analysis

Exhibit 9

Change in Satisfaction, Housing (Unit and Building) and Maintenance (Property Management)

	Change in Satisfaction with Unit and Building (Any Increase) n=72			Change in Satisfaction with Unit and Building (Dissatisfied to Satisfied) n=71			Change in Satisfaction with Property Management (Any Increase) n=72			Change in Satisfaction with Property Management (Dissatisfied to Satisfied) n=72		
	Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval		Odds Ratio	Confidence Interval	
Gender (Male)	0.343	0.081	1.444	0.660	0.118	3.693	1.992	0.461	8.612	0.706	0.113	4.408
Ethnicity (Hispanic)	0.660	0.197	2.219	0.389	0.108	1.403	3.960	1.003	15.640	1.171	0.313	4.375
Highest Education Level												
(High School or Higher)	0.913	0.295	2.826	3.472	0.982	12.277	2.167	0.630	7.450	5.663*	1.245	25.748
Vulnerable Household ^a	4.355	0.978	19.396	2.991	0.614	14.576	1.059	0.285	3.937	0.444	0.099	1.992
Years in Apartment	0.985	0.938	1.034	1.034	0.981	1.090	1.032	0.980	1.086	1.026	0.970	1.087
Repairs Completed	0.802	0.235	2.740	0.718	0.199	2.597	0.626	0.172	2.275	0.410	0.097	1.745
Bothered by Secondhand Smoke in Apartment	0.115*	0.020	0.665	0.119**	0.024	0.582						
Smoking Household										4.180*	1.053	16.595
Likes Where They Live				8.120*	1.275	51.721						
Group Membership							0.227*	0.065	0.796			
(constant)	7.464	0.867	64.235	0.164	0.017	1.622	0.137	0.016	1.163	0.109	0.010	1.139
Pseudo R ²	0.149			0.223			0.132			0.156		
AIC ^b	97.914			90.512			91.449			78.227		

*Indicates $p < 0.05$; **Indicates $p < 0.01$.

^aA household is considered to be vulnerable if members include a child under the age of 18, an adult aged 55 or older, or someone with a respiratory illness.

^bThe Akaike's Information Criterion (AIC) is a relative measure of model fit with lower scores reflecting a more appropriate model. A reduction in at least seven points represents a meaningful improvement.

Note: Group in parentheses indicates the reference group.

Source: Authors' analysis

Discussion

The present study demonstrates promising results following the RAD conversion process as it relates to resident satisfaction, smoking behaviors, and exposure to secondhand smoke. The authors examined two policy shifts at once. First, they measured adherence with the existing smoking ban in federally subsidized housing units that took effect in August 2018. Second, they assessed changes resulting from major capital improvements at a RAD site in New York City. Baseline results indicate poor compliance with the smoke-free housing policy among residents as indicated by self-reported smoking indoors or reports of secondhand smoke. Before the upgrades, residents also reported poor overall housing satisfaction, including dissatisfaction with their units, the buildings, and property management. At followup, however, smoking behaviors and secondhand smoke exposure significantly decreased, suggesting a positive shift in the yearlong time period between assessments. Residents were also generally more satisfied with their housing situation and the management of buildings. No meaningful changes were observed in resident engagement despite our team's attempts to convene with residents in partnership with a community organizer at Catholic Charities and community health workers from another local organization.

In all, the improvements in smoking behaviors, secondhand smoke exposure, and resident satisfaction may be in part attributable to the physical changes stemming from RAD-based upgrades in units and buildings. Based on observations conducted in and around the Betances housing sites throughout the data collection and interim periods, the authors identified three factors that may have affected the observed outcomes. First, residents were relieved to experience long-overdue improvements to housing units and building infrastructure and a change in property management that potentially had more bandwidth to address resident concerns. Those improvements may have reduced stress and the need to smoke as a coping strategy and inspired a sense of responsibility to preserve the home—including not smoking indoors—among residents. Second, there was an attempt to manage safety concerns in and about the buildings by incorporating lighting and intercom system upgrades to more effectively manage the flow of residents in and out of the buildings and partnering with police to target crime in the housing community. Those security measures may have promoted a greater sense of safety for people to smoke outdoors. Lastly, a concerted effort was made to engage residents throughout the process, not only in terms of informing them about how the RAD-induced changes would unfold but also to link residents to a variety of services. This may have improved tenant/landlord relations, strengthening the social contract between tenants and with the new management (Hernández et al., 2019b). These explanatory factors are illustrated in greater detail below in the following images (exhibit 10) and narrative form.

Exhibit 10

Baseline Conditions at Betances Houses



Notes: Images, from left to right: (left) bathroom in disrepair with a long-term water leak and black mold; (middle) cigarette filter and other debris in a hallway serving as evidence of smoking in common areas of the building; and (right) sign in a hallway that read "No Smoking chid Asma Than you" [sic].
Source: HaRBOR study team

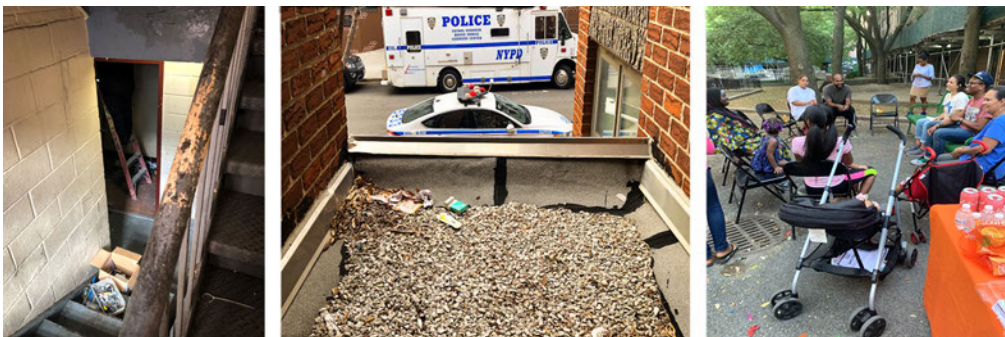
Visual inspections and engagement at the sites supported the overall trend pointing toward a reduction in the need for repairs within units and in buildings and greater satisfaction with property maintenance. The study team observed improved lighting, fresh paint, new tiles, new or more secure doors at the main entrance, and other aesthetic changes to the lobby and common areas in the buildings. Units were enhanced with fresh paint and new kitchen cabinets, appliances, flooring, and windows; many remaining maintenance concerns and poor housing conditions, such as mold, were finally addressed. Residents were generally content with the changes and the process involved with coordinating the renovations. However, some issues were unresolved, such as the presence of rodents or displeasure with aspects of the construction that were not properly completed. These outstanding issues likely relate to the finding that respondents whose repairs were completed were significantly less likely to improve their combined opinion of their unit, building, neighborhood, and property management. Respondents who received repairs, but had no increase in general satisfaction, had a greater number of complaints, on average, suggesting that a greater number of or severity in repair needs detracts from residential satisfaction.

Residents reported safety concerns mainly stemming from fellow tenants engaged in nefarious activities or non-residents who would loiter in the lobby, in front of the buildings, or in common areas such as stairwells. Throughout the study period, the team witnessed significant police presence, mostly via police vehicles stationed at the sites, with some permanent posts near locations that experienced chronic reports of crime and safety issues. In some cases, large police-issued flood lights—intended as a crime deterrent—obstructed residents' sleep due to the noise and light pollution and the noxious odors from the diesel generator that powered the lights. Residents did not necessarily express concerns about adverse interactions with police during this time, but several mentioned troubles with witnessing active substance users in and around the buildings. Property management staff and residents alike described chronic issues with keeping the front doors properly locked. However, as part of the overall changes to the buildings, new lights, camera systems, and front door intercom systems were installed to address safety concerns and provide more oversight and control of people entering the buildings.

In this time, a community organizer assigned to the Betances Houses through the development's social service partner, Catholic Charities, also made a concerted effort to conduct needs assessments within the residential community and link residents to a variety of services offered directly or through partnerships with sister agencies (see the right-most image in exhibit 11). Resident meetings were held regularly to explain the phases of construction and provide a platform for residents to ask questions and voice concerns. The developers described safety protocols and the nature of the changes. Over time, the meetings held at a local community center were better attended. This space was also used for other resident engagement activities, such as a health fair, which featured local organizations offering a variety of health and wellness services and related information. They also hosted a training on overdose prevention and a community conversation about substance use based on concerns expressed by residents. Our study team partnered with a community organizer from Catholic Charities and a local community health worker collective to host conversations within lobby areas or building courtyards about the smoke-free policy and the benefits of smoke-free housing environments. These sessions were fruitful in discussing pertinent issues but were generally poorly attended, despite active recruitment and the offer of refreshments and incentives. The one very clear exception was in a senior housing facility where upward of 30 participants attended the repeated session despite the very low smoking prevalence among participants. Their eagerness to participate demonstrated a desire to connect and the promise of delivering programs targeting seniors within housing settings.

Exhibit 11

RAD-induced Interventions at Betances Houses



RAD = rental assistance demonstration program.

Note: Images, left to right: (left) repair work being conducted in the common area of RAD building; (middle) view from building window depicting police vehicles stationed long-term outside of a RAD site, also shown are a discarded cigarette carton and cigarette filters in the gravel indicating smoking in the buildings; (right) resident meetings held outside to discuss resident needs including health, safety, and the smoke-free policy.

Source: HaRBOR study team

Emerging research confirms that housing-based health interventions can effectively leverage housing settings as a venue for the delivery of health and social services (Hernández, 2019). Housing-based programs can also assist in creating a sense of community and cultivating a culture of health within the building, including building stronger social connections among residents. Findings herein suggest that participants who felt close to other people in the community and liked where they lived reported higher levels of resident satisfaction. Nevertheless, changes in resident engagement require time and repeated attempts, particularly as trust is built between the resident

and the new property managers. Therefore, an emphasis on community-building activities among neighbors in RAD and other affordable housing sites can result in benefits to residents and property managers alike, not the least of which may affect adherence to smoke-free policies.

Strengths and Limitations

This is the first known study to evaluate the impact of RAD and the smoking ban in public housing in tandem. Secondhand smoke exposure was notably reduced following the RAD capital improvements. This reduction may be attributed to residents appreciating their place of residence more post renovations, feeling supported by community outreach efforts, and experiencing less stress from poor housing conditions. Future studies, however, should employ randomized controlled trials to better estimate causal impact and more accurately identify mechanisms leading to such improvements. Despite these promising results, this study has other key limitations. First, this study was conducted at a scattered-site RAD development in a large urban area, which is not reflective of housing developments in other parts of the country. Second, the sample size was small, and the study period of just 1 year was perhaps too short to demonstrate more substantive results. At times, results were trending in a supportive direction, but the limited number of residents in the sample size precluded the authors from reporting definitive results in some domains. As evidenced by the limited number of current smokers in the Betances sample, either social desirability bias or selection bias is suspected, as those who smoked may have been less likely to participate or answer honestly about smoking behavior due to fear of repercussions for violating the building's smoke-free housing policy. Moreover, the data collected were not precise enough to distinguish whether this evaluation motivated some of the changes in smoking behaviors. Finally, the authors were unable to retrieve data on SFHP enforcement on the part of the management company, thereby limiting their understanding of the role of warnings and other measures in contributing to the observed results. Nevertheless, this remains a first-in-kind effort that considered process-level factors (such as resident engagement activities) and measures external to the renovations (such as police activity).

Conclusion

Overall, the evidence of reductions in secondhand smoke exposure and indoor smoking behavior, and some successful quit attempts between baseline and followup assessment periods, was promising. Future qualitative data collection with smokers that improved smoking outcomes is warranted to better understand the impetus for change and whether RAD-related factors drove those behavioral changes. Respondents were significantly more satisfied with their housing, both with their apartment units and their units and buildings. Threats to satisfaction included reporting a negative health impact from conditions in the home—being bothered by secondhand smoke; the presence of mice, rats, or mildew; and outstanding repair needs. Those residents with a longer housing tenure, who liked where they lived and were smokers, experienced further improvements in residential satisfaction. A key unexpected result was that residents who remained bothered by secondhand smoke were less satisfied with the changes within their units. This finding suggested that secondhand smoke exposure detracts from satisfaction with RAD-based improvements and marks a critical opportunity for continued efforts at addressing quality of life concerns. Although

not reported here, this finding was also true of lingering safety concerns and responsiveness on the part of management to addressing resident issues and requests. Despite the vast investment in capital improvements stemming from RAD, the aforementioned concerns may undermine how residents experience their new living quarters. Hence, efforts to provide smoking cessation services and resident engagement tactics are warranted to further support smoke-free housing policy adherence in the context of RAD.

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