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Original investigation

# Assessment of Residents' Attitudes and Satisfaction Before and After Implementation of a Smoke-Free Policy in Boston Multiunit Housing

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## Abstract

**Introduction:** In 2012, the Boston Housing Authority (BHA) in Massachusetts implemented a smoke-free policy prohibiting smoking within its residences. We sought to characterize BHA resident experiences before and after the smoke-free policy implementation, and compare them to that of nearby residents of the Cambridge Housing Authority, which had no such policy.

**Methods:** We recruited a convenience sample of nonsmoking residents from the BHA and Cambridge Housing Authority. We measured residents' awareness and support of their local smoking policies before and 9–12 months after the BHA's policy implementation, as well as BHA respondents' attitudes towards the smoke-free policy. We assessed tobacco smoke exposure via saliva cotinine, airborne apartment nicotine, and self-reported number of days smelling smoke in the home. We evaluated predictors of general satisfaction at follow-up using linear regression.

**Results:** At follow-up, 91% of BHA respondents knew that smoking was not allowed in apartments and 82% were supportive of such a policy in their building. BHA residents believed enforcement of the smoke-free policy was low. Fifty-one percent of BHA respondents indicated that other residents "never" or "rarely" followed the new smoke-free rule and 41% of respondents were dissatisfied with policy enforcement. Dissatisfaction with enforcement was the strongest predictor of general housing satisfaction, while objective and self-reported measures of tobacco smoke exposure were not predictive of satisfaction. At follow-up, 24% of BHA participants had complained to someone in charge about policy violations.

**Conclusions:** Resident support for smoke-free policies is high. However, lack of enforcement of smoke-free policies may cause frustration and resentment among residents, potentially leading to a decrease in housing satisfaction.

**Implications:** Smoke-free housing laws are becoming increasingly prevalent, yet little is known about satisfaction and compliance with such policies post-implementation. We evaluated nonsmoking

residents' attitudes about smoke-free rules and their satisfaction with enforcement 1 year after the BHA implemented its comprehensive smoke-free policy. We found that while residents were supportive of the policy, they believed enforcement was low, a perception that was associated with a drop in housing satisfaction. Our findings point to a desire for smoke-free housing among public housing residents, and the importance of establishing systems and guidelines to help landlords monitor and enforce these policies effectively.

## Introduction

Tobacco smoke exposure (TSE) is a leading cause of death, with secondhand smoke causing more than 41 000 deaths per year. TSE also causes heart disease, stroke, and lung cancer, and exacerbates asthma as well as other respiratory illnesses.<sup>1,2</sup> Low-income individuals living in multiunit housing are particularly vulnerable to TSE, as smoke from one unit can disperse throughout the building by way of hallways, ventilation systems, and other spaces.<sup>3,4</sup> TSE is especially harmful to those residing in public housing including children, African Americans, the elderly, and the disabled. Asthma, which is sensitive to TSE,<sup>1,5</sup> is highly prevalent among urban dwelling and low income individuals, including those in public housing.<sup>6</sup> Public housing residents' vulnerability to TSE is heightened because they are often in housing of last resort without the means to avoid exposure by changing residences. In a recent review of multiunit housing smoke-free policies, Snyder et al.<sup>7</sup> found that the proportion of residents self-reporting that they had experienced secondhand smoke incursions in their units was generally high, with prevalence ranging from 26% to 64% across studies.

In 2012, the Boston Housing Authority (BHA) instituted a comprehensive smoke-free policy that newly prohibited smoking in all residential units, becoming the largest public housing authority to do so at the time. The goal of the policy was to reduce nonsmoking tenants' residential TSE and to reduce cleaning costs and resident complaints associated with tobacco smoking in BHA properties. BHA administrators reported that a primary reason for transfer requests prior to the policy was neighbors' tobacco smoke. The policy was therefore believed to improve general resident satisfaction.

This article investigates nonsmoking residents' attitudes and beliefs about smoke-free rules, and their satisfaction with enforcement and housing in general 1 year after the BHA implemented its smoke-free policy. Although several previous studies have examined theoretical support for multiunit housing smoke-free policies, little is known about satisfaction and compliance with such policies after actual implementation. We make a novel contribution to the literature by assessing residents' satisfaction both before and after the policy and examine the possible reasons for any dissatisfaction, including ongoing TSE (using both objective and subjective measures of exposure) and perceived enforcement quality. Furthermore, where appropriate we also compare BHA residents' responses to those of residents in the neighboring Cambridge Housing Authority (CHA), which had no such smoke-free policy, as a control site.

## Methods

### Setting and Participants

The study was conducted in the Boston and Cambridge Housing Authorities located in neighboring cities in Massachusetts. The BHA owns 27 family developments that house approximately 18 000 residents in nearly 7000 units. The CHA owns nine family developments

that house 3700 residents within 1500 units. Both BHA and CHA developments are similar garden-style, midrise apartment buildings and are comparable in size, age, and date of most recent renovation.

### BHA Smoke-Free Policy

The BHA's smoke-free policy was implemented on September 30, 2012. The policy extended the existing prohibition on smoking in buildings' interior common spaces (hallways, stairways, social rooms, etc.) to include residents' apartments. Managers had the discretion to prohibit smoking in outdoor areas, such as a 15-foot (approx. 3 m) perimeter around the apartment buildings. The ban applies to all residents, visitors, and employees. Residents in violation of the policy may be subject to fines of up to \$250 and possible eviction for repeat offenses. In the year prior to the policy change, community meetings were held at all of the BHA developments to educate residents and local building managers of the impending policy. Additionally, residents were required to sign a lease addendum acknowledging they had been informed of the policy. The CHA allowed smoking in residents' apartments during this time period, but not in indoor common spaces.

### Recruitment

At baseline, prior to the BHA policy implementation, we recruited a convenience sample of nonsmoking residents from the seven most populous developments in each housing authority (number of residents in the selected developments ranged from 856 to 2174 in the BHA and from 129 to 657 in the CHA). We recruited one adult resident per study household ( $\geq 18$  years old). Eligibility criteria included being a nonsmoker (smokers were defined as those using cigarettes, cigars, blunts, or pipes), living in a unit where no other resident smoked, an ability to communicate in English or Spanish, and no current use of nicotine replacement therapies. Nonsmokers were recruited because the policy was designed to protect nonsmokers from TSE.

Participants were recruited in two ways. First, a letter was sent to the head of household asking for participation in the study. Second, trained field staff visited developments to conduct additional recruitment on-site. The study was covered by a Certificate of Confidentiality from the National Institutes of Health to assure residents that if prohibited tobacco use was observed by or disclosed to researchers during the study, that information would be inaccessible to the housing authorities. Participants provided informed consent and subsequently completed a study interview. Participants also provided a saliva sample, and had a passive nicotine monitor placed in the main living area of their apartments. We used passive instead of active monitors due to budgetary and logistical concerns. Upon completing baseline data collection, participants received \$30. Follow-up data collection was conducted approximately 1 year after their first interview. Upon completing the follow-up data collection, participants received \$40. The Institutional Review Boards

of Partners HealthCare and the New England Research Institutes approved the study.

## Measures

### Attitudes Regarding Smoke-Free Housing Policies

BHA and CHA residents' awareness of their local smoking policies was measured at follow-up, with the questions, "Please tell me which rule is the most like your apartment building's rules [about smoking] for the inside of the building" (see [Supplementary Appendix Table 1](#) for questionnaire items and response choices). At follow-up, the correct rule in Boston was, "Smoking is not allowed anywhere inside the building, even inside apartments", while the correct rule in Cambridge was, "Smoking is not allowed anywhere inside the building except in apartments."

Residents' support for smoke-free policies was evaluated via five items at follow-up ([Supplementary Appendix Table 1](#)). Residents were asked whether there should be formal rules about smoking, whether people in their building should be allowed to smoke in their own apartments, the importance of a resident's right to smoke in his or her own apartment, and the importance of a resident's right to breathe air free of tobacco smoke. Residents were also asked to indicate which was more important, a resident's right to smoke in his or her apartment or a resident's right to breathe air free of smoke in his or her apartment.

Next, we evaluated BHA respondents' satisfaction with the policy introduction and implementation, as well as their perceptions about whether residents were obeying the new policy. BHA respondents were also asked to identify through closed-ended questions where they most often saw people smoking around their building or development.

Next, we assessed BHA respondents' beliefs on what should occur when residents break a smoke-free rule ("Nothing", "Give the resident a serious warning", "Deny the resident the chance to renew their lease", or "Evict the resident."). Respondents were also asked whether a resident should be fined 1 month's rent if caught breaking the no-smoking rule. Respondents' attitudes towards residents who break rules were measured via items asking whether a respondent would tell a neighbor who was smoking to stop, whether a respondent would tell a manager about that person, and whether the respondent had in the past 6 months complained to someone in charge about another resident smoking ([Supplementary Appendix Table 1](#)).

### General Housing Satisfaction

BHA residents' general housing satisfaction was assessed via four items from the Customer Service and Satisfaction Survey previously used by the US Department of Housing and Urban Development.<sup>8</sup> The items had the following structure: "How satisfied are you with your..." and included "apartment/home," "property/building," "neighborhood," and "property/building management," asked in both the baseline and follow-up surveys, with response choices "Very satisfied," "Satisfied," "Dissatisfied," and "Very dissatisfied." An overall satisfaction score was calculated by giving numeric values of 0 for "very dissatisfied" to 3 for "very satisfied" to each item, summing the values, and dividing by the total possible satisfaction score to create a percentage. The summed score ranged from 0 to 12 and the percentage from 0% to 100%.

### Tobacco Smoke Exposure

Tobacco smoke exposure was assessed via three measures: self-report, saliva cotinine, and airborne nicotine in the apartment.

Self-reported TSE was ascertained with the following question: "In the past 7 days, have you smelled tobacco smoke in your home? [yes/no]"

Cotinine is a standard biomarker for TSE, reflecting exposure over approximately 5 days prior to sample collection.<sup>9</sup> Participants were asked to provide saliva samples at both the baseline and follow-up interviews. Samples were analyzed by the Clinical Pharmacology Laboratory at the University of California San Francisco using a high-sensitivity LC-MS/MS method (lower limit of detection 0.02 ng/mL).<sup>10</sup>

Airborne nicotine was assessed using passive monitors that were exposed in apartments for at least 7 days. Monitors were analyzed by gas chromatography at the University of California, Berkeley.<sup>11</sup> This procedure has a lower limit of detection of 5 µg.

### Demographic Variables

Demographic variables that were gathered in the baseline survey included gender, nationality (US born or not), age, education, marital status, employment status, race/ethnicity (black, Hispanic/Latina(o), white, or other), tenure in the apartment, and whether or not a child lived in the home.

### Data Analysis

Chi-square tests were used to test differences in sociodemographic characteristics by site at baseline. To test whether opinions about smoking rules differed across the BHA and CHA sites, we conducted linear regressions and corresponding F tests. We used unadjusted as well as adjusted regressions, adjusting for all demographic covariates. To compare baseline satisfaction to follow-up satisfaction for BHA participants, paired *t* tests were used. To compare satisfaction scores at follow-up for BHA respondents across differing opinions of the smoke-free rules, we used independent sample *t* tests with unequal variances. To evaluate associations between objective measures of TSE with general satisfaction scores, pairwise correlations were conducted.

Lastly, in order to investigate the factors that affect overall satisfaction, we performed an analysis of changes in general housing satisfaction among BHA respondents using multivariable linear regression with standard errors clustered at the development level.<sup>12</sup> The model predictors include an indicator for dissatisfied or very dissatisfied with rule enforcement, indicators for detectable levels of cotinine and nicotine, an indicator that a respondent smelled smoke in their apartment in the past 7 days, baseline satisfaction score and demographic variables. Data analyses were conducted using Stata 13.1 (College Station, TX).

## Results

At baseline, 297 participants completed an interview. A total of 239 (74 CHA, 165 BHA) completed the follow-up interview. Of those, 10 participants (7 CHA, 3 BHA) had levels of cotinine that were greater than 15 ng/mL at baseline and were therefore considered smokers and ineligible for the study. [Table 1](#) presents the sociodemographic characteristics of eligible survey respondents who participated at both baseline and follow-up. In both BHA and CHA, most respondents were female (87% and 75%, respectively). In BHA, the large majority of respondents were Hispanic (65%) and not born in the United States (67%). In CHA, the majority of respondents were black (56%) and also not born in the United States (66%). A total of 57% and 61% of BHA and CHA respondents, respectively, had a child living in the home.

## Awareness and Support for Smoke-Free Rules

Table 2 shows the proportion of residents in BHA and CHA at follow-up that identified the correct rule on smoking in their apartment building. The vast majority of BHA respondents (91%) knew the correct rule. Only 5% did not know the rule and only 4% identified an incorrect rule. In contrast, CHA respondents generally did not know the rule about smoking for their housing authority, with 30% stating they were not sure, and 55% identifying an incorrect rule (adjusted  $P < .001$ ). Of CHA participants who identified the rule incorrectly, 52% identified a rule stricter than the actual rule in place.

BHA participants were generally more supportive of a smoke-free policy than CHA participants (Table 2). At follow-up, 77% of BHA participants agreed that, "There should be formal rules about smoking", while only 60% of CHA participants agreed with that statement. More CHA participants had no preference about smoking rules (26%) than BHA participants (12%; adjusted  $P = .045$ ).

At follow-up, most respondents in both BHA (82%) and CHA (76%) developments disagreed or strongly disagreed with the statement that "People in [my] building should be allowed to smoke in their own apartments" (adjusted  $P = .32$ ). However, 18% of BHA respondents and almost a quarter of CHA respondents (all of whom were nonsmokers) believed that people should be allowed to smoke in their own apartments (Table 2).

At follow-up, 70% of BHA participants believed that a resident's right to smoke in his/her apartment was "not at all important" compared to 57% of CHA participants, although the difference was not significant (adjusted  $P$  value = .12). The vast majority of both BHA and CHA study participants (95% and 93%, respectively) believed a resident's right to breathe air free of smoke in his/her apartment was "very important" (adjusted  $P$  value = .25), and nearly all respondents, including those endorsing the right to smoke in apartments reported that the right to breathe air free of smoke was more important than the right to smoke in apartments (96% of BHA and 93% of CHA respondents,  $P = .24$ ; Table 2).

## Perceptions of Implementation and Enforcement of BHA Smoke-Free Policy

Many BHA respondents believed their neighbors were not following the new smoking rules. Although 87% of BHA participants were satisfied or very satisfied with the way the BHA had introduced their rules about smoking, 41% of BHA respondents reported being "dissatisfied" or "very dissatisfied" with the way that the BHA had enforced the rules. About half of respondents (51%) believed that others in the building "never" or "rarely" follow the rules (Table 3). When asked to identify where participants most often saw people smoking around their building or development, 13% of BHA participants reported, "In public spaces inside the building", 26% "Near doorways/entrances", 27% "In other public spaces around the building", and 18% responded "On the sidewalks around the development".

## Consequences of Rule Breaking

BHA participants' negative perceptions of the enforcement of the policy do not translate into desire for strict punishments of offenders. The majority of BHA participants wanted to give the resident a warning (74%) when a resident has been caught breaking the no-smoking rule three times. Only 13% wanted to deny the resident lease renewal, 10% wanted to evict the resident, and 1% wanted to

**Table 1.** Sociodemographic Characteristics of Boston Housing Authority (BHA) and Cambridge Housing Authority (CHA) Respondents at Baseline

	BHA, N = 158		CHA, N = 71		P
	No.	%	No.	%	
Female	137	87	53	75	.03
Age (y)					
<30	11	7	7	10	.93
30–39	31	20	14	20	
40–49	35	22	17	24	
50–59	37	23	16	23	
>60	44	28	17	24	
Education (y) <sup>a</sup>					
<12	67	43	19	27	.06
12	43	28	23	32	
>12	46	29	29	41	
Marital status					
Married/living tog	39	25	29	41	.05
Divorced/sep/widow	52	33	19	27	
Single, never married	67	42	23	32	
Employment					
Working for pay/student	60	38	38	54	.10
Unemployed/temp leave	22	14	11	15	
Disabled	43	27	9	13	
Retired	21	13	9	13	
Homemaker	12	8	4	6	
Race					
White	10	6	8	11	<.001
Hispanic/Latina(o)	102	65	14	20	
Black	37	23	40	56	
Other	9	6	9	13	
Housing tenure (y)					
<1	10	6	9	13	.20
1–2	14	9	9	13	
2–5	31	20	10	14	
5–9	47	30	25	35	
≥10	56	35	18	25	
Born in United States	52	33	24	34	.90
Has child in home	90	57	43	61	.61

<sup>a</sup>Two missing education from BHA.

do nothing at all. However, when asked directly, 84% of participants felt that residents should be fined 1 month's rent (set at approximately 30% of resident's monthly income) if the resident or resident's guest had been caught breaking the rule at least three times.

BHA participants appear to feel uncomfortable complaining about their neighbors' smoking. At follow-up, slightly more than half (53%) would tell a neighbor to stop smoking if they saw the neighbor smoking somewhere in the development that was against the rules. About 58% would tell a manager about such an incident. At follow-up, about a quarter of BHA participants (24%) said they had complained to someone in charge in the past 6 months when a person was smoking inside the building where it was not allowed. Even among participants who believed rules were never or rarely being followed, only 36% had complained in the past 6 months.

## Resident Satisfaction

General housing satisfaction of BHA respondents decreased slightly from 58% at baseline to 54% at follow-up (Supplementary Appendix

**Table 2.** Perceptions About Smoking Rules Among Boston Housing Authority (BHA) and Cambridge Housing Authority (CHA) Residents at Follow-Up, *N* (%)

	BHA, <i>N</i> (%)	CHA, <i>N</i> (%)	Unadjusted <i>P</i> value	Adjusted <i>P</i> value <sup>a</sup>
Ability to identify correct Housing Authority rule for smoking inside the building				
Identified correct rule	143 (91)	11 (15)	<.001	<.001
Identified incorrect rule	7 (4)	39 (55)		
Don't know the rule	8 (5)	21 (30)		
Agreement with formal rules about smoking in housing				
There should be formal rules about smoking	121 (77)	42 (60)	.02	.045
People should work out rules about smoking themselves	18 (11)	10 (14)		
No preference about formal rules	19 (12)	18 (26)		
Response to: "People in [my] building should be allowed to smoke in their own apartments."				
Strongly disagree or disagree	129 (82)	54 (76)	.33	.32
Response to: "In your opinion, how important is a resident's right to smoke in his or her own apartment?"				
Not at all important	110 (70)	39 (57)	.07	.12
Response to: "In your opinion, how important is a resident's right to breathe air free of tobacco smoke in his or her own apartment?"				
Very important	150 (95)	65 (93)	.53	.24
Response to: "In your opinion, which is more important:"				
A resident's right to smoke in his or her apartment	6 (4)	5 (7.0)	.29	.25
A resident's right to breathe air free of tobacco smoke in his or her own apartment	150 (96)	65 (93)		

<sup>a</sup>Adjusted model controlled for tenure, sex, age, marital status, education, race, employment status, born in United States, and whether there is a child in the home.

Table 2). There was a significant decrease in satisfaction with property management from 70% at baseline to 61% at follow-up, (−8 percentage points;  $P = .03$ ). There was also a significant increase in satisfaction with the neighborhood from 65% to 72%, a change of 8 percentage points ( $P = .04$ ). Satisfaction with building and home stayed about the same (63% to 66%,  $P = .39$  and 70% to 69%,  $P = .73$ , respectively).

General housing satisfaction was lower for those with negative opinions of policy implementation. Those participants satisfied or very satisfied with enforcement of rules had an overall satisfaction percentage of 63% compared to 40% for those dissatisfied or very dissatisfied with enforcement ( $P < .001$ ; Table 3). General housing satisfaction was also lower for those who had negative opinions about residents following the new smoke-free rules. Those who believed that others generally followed the smoking rule "all of the time," "often," or "sometimes" had an average satisfaction score of 62% compared to 46% for those who believed that others only followed the rule "rarely" or "never" ( $P < .001$ ). Those who complained to someone in charge in the past 6 months about a neighbor breaking the smoke-free rules had lower satisfaction scores than those who did not complain (44% compared to 57%, respectively;  $P = .008$ ).

Surprisingly, overall satisfaction was not associated (Pearson correlation) with subjective or objective measures of TSE, including days in the past week the resident smelled smoke in the apartment ( $P = .17$ ), saliva cotinine levels ( $P = .98$ ), or apartment nicotine levels ( $P = .64$ ).

### Predictors of Satisfaction at Follow-Up

Table 4 presents the results of the multivariable linear regression model for the predictors of general housing satisfaction of BHA respondents at follow-up. After adjusting for baseline satisfaction, TSE levels, and demographics, dissatisfaction with rules enforcement was a strong predictor of general housing satisfaction, lowering overall housing satisfaction by 14 percentage points (95% CI = −22% to −6%). Objective and subjective levels of TSE were not

associated with general satisfaction. Results were robust to various specifications of the TSE variables including using continuous measures and adding one at a time in case of multicollinearity. None of the demographic variables were associated with satisfaction.

### Discussion

The federal Department of Housing and Urban Development issued letters in 2009 and in 2012 encouraging the adoption of smoke-free policies in all public housing authorities.<sup>13,14</sup> In 2012, the BHA became the largest public housing authority in the United States to prohibit smoking within residential units at that time. The BHA's decision to embark on the process of developing and implementing an authority-wide smoke-free policy for residences was sparked in part by dissatisfaction expressed by some nonsmoking residents with respect to tobacco smoke incursions and their health effects. By characterizing the experiences of a broader sample of BHA residents before and after implementation of the policy, we sought to identify lessons that might be drawn from this bellwether institution. We found that although BHA residents were highly supportive of the policy both before and after implementation, they believed enforcement was low. This perception of poor enforcement was associated with an overall drop in housing satisfaction among the nonsmoking residents. The implications of our findings in informing public health policy point to both an evident desire for smoke-free housing among low-income residents living in public housing, as well as the importance of establishing systems and guidelines to help landlords monitor and enforce these policies effectively.

The principal goal of the BHA policy was to protect nonsmoking residents from exposure to their neighbors' tobacco smoke; prior to the policy, BHA administrators reported that residents were bothered by TSE and cited a neighbor's tobacco smoke as a primary reason for transfer requests (Personal communication with John Kane, November 2014). At the time we began data collection, the BHA had completed an extensive information campaign designed to educate residents and local building managers about the dangers of TSE and of the impending policy.

**Table 3.** Attitudes and General Satisfaction of Boston Housing Participants About Smoke-Free Rules at Follow-Up

	N (%)	Mean general satisfaction score (%)	P value for difference in satisfaction
In your experience, how often do people follow the rules about smoking in the building? <sup>2a</sup>			
Never or rarely	76 (51)	46	<.001
All of the time, often, or sometimes	74 (49)	62	
How satisfied are you with the way the BHA introduced their rules about smoking? <sup>2a,b</sup>			
Very satisfied or satisfied	66 (87)	57	.01
Very dissatisfied or dissatisfied	10 (13)	37	
How satisfied are you with how your development has enforced rules about smoking? <sup>2a</sup>			
Very satisfied or satisfied	89 (59)	63	<.001
Very dissatisfied or dissatisfied	61 (41)	40	
Where do you most often see people smoking around your building or development either indoors or outdoors?			
Public spaces inside building	20 (13)	33	.001 <sup>d</sup>
Private spaces inside building	4 (3)	75	
Near doorways/ entrances	41 (26)	53	
Public spaces outside building	42 (27)	55	
On the sidewalks	29 (18)	59	
Elsewhere	2 (1)	75	
Have not noticed smoking	20 (13)	63	
In your opinion, when housing authorities have rules against smoking in residents' apartments, what should they do when a resident or a resident's guest has been caught breaking the rule at least three times? <sup>2c</sup>			
Nothing	2 (1)	83	.71 <sup>d</sup>
Give resident serious warning	117 (74)	54	
Deny the resident the chance to renew lease	21 (13)	52	
Evict the resident as soon as possible	16 (10)	54	
In your opinion, when housing authorities have rules against smoking in residents' apartments, if a resident or a resident's guest has been caught breaking the no-smoking rule at least three times, should the resident be fined one month's rent?			
Yes	133 (84)	54	.99
No	25 (16)	54	
If you saw a neighbor smoking somewhere in the development where smoking is against the rules, would you tell that neighbor to stop? <sup>2a</sup>			
Yes	79 (53)	54	.87
No	71 (47)	54	
If you saw a neighbor smoking somewhere in the development where smoking is against the rules, would you tell the building manager that someone was smoking? <sup>2a</sup>			
Yes	87 (58)	53	.68
No	63 (42)	55	
In the past 6 months, have you ever complained to someone in charge when a person was smoking inside the building where it is not allowed? <sup>2a</sup>			
Yes	36 (24)	44	.008
No	114 (76)	57	

BHA = Boston Housing Authority. *n* = 158. Percentages may not sum to 100 due to rounding. *P* value from two sample *t* test unless otherwise noted.

<sup>a</sup>Only asked of those who claimed they knew the rule about smoking in their building (*n* = 150).

<sup>b</sup>Response not given for 61 respondents.

<sup>c</sup>Response not given for two respondents.

<sup>d</sup>*P* value from overall *F* test comparing mean satisfaction across groups.

Our results indicate that the information campaign was successful in raising awareness of the new policy. The vast majority of BHA participants knew the correct rule in their building, while at our comparator site participants were unsure. Support for a smoke-free policy was high among both BHA participants as well as those of our comparator site. These results are comparable to the hypothetical support of nonsmokers found at other public and subsidized housing sites elsewhere in the United States, including Minnesota (79% preferred a smoke-free building),<sup>15</sup> New York (61.6% would favor the implementation of a smoke-free policy),<sup>16</sup> and Tacoma, Washington (82% of nonsmokers agreed with policies that would ban smoking in homes).<sup>17</sup> In Portland, Oregon, where a smoke-free rule was actually implemented along with an informational campaign, 85% of former smokers and 92% of never smokers were “very” or “somewhat” happy with the smoke-free policy.<sup>18</sup>

On the other hand, there was a widespread belief among respondents that enforcement of the smoke-free policy 9–12 months after implementation was poor. About half of BHA respondents believed that others in the building “never” or “rarely” follow the new smoke-free rules and two fifths were dissatisfied with how their development had enforced rules about smoking. The dissatisfaction with rule enforcement was the largest and most significant predictor of general housing satisfaction, while objective and subjective measures of TSE were not predictive of satisfaction. This may be because TSE, while important for health, may not be as important a driver of satisfaction as other public housing issues including poverty, crime, maintenance, and neighbor disputes. Nevertheless, most residents were hesitant to complain about transgressors in their building and did not advocate for the stronger penalties the BHA had put in place (eviction or denying lease renewal). Even among respondents who

**Table 4.** Multivariable Predictors of General Satisfaction at Follow-Up,  $n = 140^a$ 

	General satisfaction at follow-up
Dissatisfied with rules enforcement	-0.14* (-0.22, -0.06)
Nicotine level detectable (yes vs. no)	0.02 (-0.06, 0.10)
Cotinine level detectable (yes vs. no)	-0.03 (-0.09, 0.03)
Smelled smoke at least 1 day in past week	0.02 (-0.09, 0.13)
Baseline satisfaction score	0.61** (0.54, 0.69)
$R^2$	0.57

Regressions control for tenure, sex, age, marital status, education, race, employment status, born in United States, and whether there is a child in the home. 95% confidence intervals (CIs) in brackets; Standard errors clustered at development level. Satisfaction score is sum of satisfaction of home, building, neighborhood, and property management with 0 = very dissatisfied to 3 = very satisfied, divided by total possible satisfaction.

<sup>a</sup>Missing values of satisfaction of rule enforcement for those who claimed they did not know the policy on smoking ( $n = 8$ ), missing cotinine at follow-up ( $n = 3$ ) and missing nicotine levels at follow-up ( $n = 7$ ).

Significant associations are indicated by \* $P < .01$ ; \*\* $P < .001$ .

believed that others “never” or “rarely” follow the nonsmoking rules, only 36% had complained in the past 6 months.

Previous studies assessing compliance with existing smoke-free multiunit housing building policies found high rates of violations. In a survey of property managers in four Virginia cities, half of property managers with smoke-free policies reported that tenants had violated the policy.<sup>19</sup> Five months after implementation of a smoke-free policy in subsidized housing in Portland, Oregon, 56% of smokers reported that they did not follow the policy and 91% of managers found enforcement difficult; on the other hand, managers reported few tenant complaints.<sup>20</sup> Other studies have also found that building managers and operators considering smoke-free policies perceive monitoring and enforcement as the biggest barriers to implementing smoke-free building policies, alongside concerns of losing tenants and increases of vacancy and turnover rates.<sup>19,21,22</sup>

These findings have important policy implications. Information campaigns by the housing authority are effective for increasing resident awareness and support. However, lack of enforcement of smoke-free policies may cause frustration and resentment among residents, potentially leading to a decrease in housing satisfaction. Additionally, the disconnect between satisfaction with enforcement and residents’ willingness to lodge complaints within the BHA should prompt housing authorities implementing smoke-free policies to carefully consider timely, simple, and anonymous mechanisms for residents to alert management to violations. Our results point to the critical need of establishing guidelines for landlords on best practices for implementation, monitoring, and enforcement of non-smoking policies.

Moreover, to maximize the efficacy of smoke-free policies, enforcement should be combined with cessation resources and assistance. As the BHA smoke-free policy was being introduced (but before it went into effect), smoking cessation classes were offered to residents in an effort to help residents quit smoking; however, they were not well attended. For smoking cessation resources to be effective, they should be provided flexibly, at no cost to smokers, and on a continuous basis.

There are limitations to our analysis. We used a convenience sample of nonsmoking residents and there may be selection bias if those who chose to participate have the strongest feelings about smoking

in the building. Our respondents were all nonsmokers, a choice driven by the goal of the main study which was evaluate the effect of the smoke-free rule on nonsmokers TSE. Unsurprisingly, existing research suggests that attitudes among smokers are substantially more negative about smoke-free policies.<sup>15,18</sup> We also did not assess e-cigarette use, which is becoming increasingly prevalent. Although we assessed comparability of BHA to CHA on a number of building and individual characteristics, we were not able to ascertain comparability on other potentially important characteristics such as proportion of residents who are smokers.

Recently, the Philadelphia Housing Authority voted to ban smoking in all Philadelphia Housing Authority units beginning in August 2015, becoming the largest public housing authority to do so.<sup>23</sup> At the same time, there are indications that HUD will initiate the federal rule-making process to institute a national smoke-free policy for public housing authorities in the next year. As the push for smoke-free policies gains momentum, the importance of effective implementation and enforcement is critical to prevent backlash and dissatisfaction. In order for these public housing smoking bans to be effective and viewed positively by residents, policies should be introduced with informational campaigns, developed with resident input, and strictly and fairly enforced by the property management with an anonymous resident complaint system. Future research should evaluate resident satisfaction over the long run and evaluate smokers’ opinions of the fairness of the implementation and enforcement of the smoke-free policies.

## Supplementary Material

Supplementary Appendix Tables 1 and 2 can be found online at <http://www.ntr.oxfordjournals.org>

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## Declaration of Interests

None declared.

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