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Attitudes and Experiences with Secondhand Smoke and Smoke-free Policies among Subsidized and Market-rate Multiunit Housing Residents Living in Six Diverse Communities in the United States

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Abstract

Background—Given that higher smoking rates persist among lower socioeconomic populations, multiunit housing (MUH) environments may result in higher secondhand smoke (SHS) exposures among subsidized MUH residents. This cross-sectional assessment compares experiences with SHS and smoke-free policies among subsidized and market-rate MUH residents living in 6 U.S. communities.

Methods—MUH residents (n=1,565) were surveyed regarding their smoke-free rules (home, building), SHS exposures, and preferences toward smoke-free policies. Binary logistic regression identified predictors of each outcome, focusing on differences by subsidized housing status (subsidized vs. market-rate).

Results—Among residents enforcing smoke-free home rules (76%, overall), 50% reported SHS incursions into their unit. Only 23% reported living in a smoke-free building; 56% living in smoking-allowable buildings reported preferences toward smoke-free building policies. Among market-rate housing residents, smoke-free home (OR=4.18) and building (OR=2.26) rules were significantly higher when children were present. Smoke-free building rules reduced the odds of SHS incursions among market-rate housing residents (OR=0.50), but no association was observed among subsidized housing residents. Non-smoking subsidized housing residents exhibited stronger preferences for smoke-free policies compared to those in market-rate housing.

Discussion—Smoke-free home rules do not protect MUH residents from SHS exposures, particularly in subsidized MUH. Although strong preferences toward smoke-free policies were

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present overall, subsidized MUH residents may have fewer alternative smoke-free housing options available. Therefore, all publicly funded housing should be smoke-free to protect these vulnerable populations. However, continued efforts to encourage privately owned MUH operators to adopt smoke-free policies are also necessary.

Keywords

Secondhand Smoke; Multiunit Housing; Policy; Smoke-free

Introduction

The U.S. Surgeon General has extensively documented the harmful health effects of secondhand smoke (SHS) exposure, concluding that there is no safe level of exposure to SHS.[1] While there is strong support for smoke-free policies in public places,[2-4] only about half of the U.S. population is covered by a comprehensive smoke-free law prohibiting smoking inside all workplaces, bars, and restaurants.[5]

Smoke-free air legislation has contributed to reductions in SHS exposures among U.S. adults and children, but gaps in protection remain, particularly in private settings such as homes and vehicles.[1,6] While the prevalence of U.S. households with voluntary smoke-free home rules has increased considerably over the last two decades,[6,7] this space still represents a major source of SHS exposure in both children and adults.[1,8-10] Despite efforts to reduce SHS exposure in public places, about a third of U.S. adults, and approximately 32 million children remain involuntarily exposed to SHS.[7,11] These gaps in protection are not randomly distributed in the population, as disparities in SHS exposures are also observed by socioeconomic status (SES).[12] Over the last two decades, the magnitude of the decline in SHS exposures has been smaller for lower SES populations, widening the gap between low and high income groups for SHS exposures.[11]

Multiunit housing (MUH) environments may perpetuate these disparities. Over 79 million individuals, or about 25% of the U.S. population, currently reside in MUH,[13] though a greater proportion of MUH residents live below the poverty line and identify as racial or ethnic minorities compared to the U.S. population overall.[13-15] Air circulation patterns inside MUH can facilitate the migration of tobacco smoke through shared hallways and ventilation systems, potentially entering into units and areas where smoking is otherwise restricted.[9,16-19] Therefore, despite having a similar prevalence of smoke-free homes rules as the U.S. population overall,[7] it is estimated that 27.6 – 28.9 million MUH residents are exposed to SHS in their home.[13] Given the socioeconomic disparities in MUH residency[13-15] and in the prevalence of smoking,[12] MUH environments may put vulnerable populations, including children, the elderly, and those who are disabled, at an increased risk of health complications due to SHS exposures.

Due to differences in resident populations, attitudes and experiences with SHS and preferences toward smoke-free policies may vary between residents of subsidized (public, affordable) and market-rate MUH. However, literature to date has primarily focused on either subsidized,[20-23] or market-rate housing residents,[24,25] exclusively, or has not distinguished the study population according to subsidized housing status.[26-29] The

purpose of this paper is to describe and compare the experiences and preferences toward SHS exposures and smoke-free housing policies among both subsidized and market-rate MUH residents living in 6 diverse communities throughout the U.S.

Methods

This paper describes the baseline data analysis of a community based educational intervention aimed at increasing the adoption of smoke-free MUH policies that was initiated in three community pairs across the U.S.: Bismarck (BM) and Grand Forks (GF), ND, Fort Collins (FC) and Pueblo (PB), CO, and Charleston (CH) and Columbia (CO), SC.

Data were collected between August and December, 2012 by telephone. Individuals aged 18 and older who resided in MUH (apartment, duplex, double/multi-family home, condominium, or townhouse) and lived in each specified community were eligible for this study. Data collection was initiated using random digit dial (RDD) of landline (n=18,000) and cell phone (n=60,000) numbers that were restricted to zip codes that represented each community. Commercially available lists of renters in each community were also included in the sampling frame. The renter lists (n=3) were called consecutively and duplicate records were excluded. Calling on these samples (RDD and listed) were completed until samples were exhausted. Figure 1 provides the number of completed interviews, Response Rates (RDD) and Participation Rates (Lists) for each data source. The response rate for the RDD component was 32.1% (combined cell and landline), calculated using the American Association for Public Opinion Research (AAPOR) Response Rate #3 calculator.[30] The participation rates for the listed samples ranged from 7.5% to 12.1% after exclusion of ineligible records. In households with more than one adult, a random selection process determined who was interviewed. The survey took approximately 25 minutes to complete. All MUH residents who completed the survey were mailed a check for \$10. All study procedures were approved by the Institutional Review Board at Roswell Park Cancer Institute.

Measures

1. Enforcing a voluntary smoke-free home rule was defined as a response of “No” to the question: “Do you allow smoking inside your residence?”
2. Experiencing a SHS incursion into the unit was defined as a response of “Everyday”, “A few times a week”, “A few times a month” or “Rarely” to the question: “In the past 12 months, how often has tobacco smoke entered your unit from somewhere else in or around your building? (vs. “Never”)” Analyses of SHS incursions are restricted to respondents who enforced voluntary smoke-free home rules (n=1,259).
3. Two questions were combined to determine the rules about smoking inside the building:
 - a. Any Rules about smoking in the building were defined as a response of “Yes” to the question: “Regardless of whether you personally have set

4. Preferences toward smoke-free building policies were defined as an answer of “Yes” to the question: “Would you prefer to have a policy in your building that prohibits smoking in all indoor areas, including individual residential units and common indoor areas?” Analyses of preferences are restricted to MUH residents who live in smoking-allowable buildings (n=1,061).

The primary predictors of interest were the respondent's subsidized housing status and smoking status.

Subsidized housing residents were defined by an answer of “yes” the question “Do you currently live in public, affordable or subsidized housing or participate in a voucher or low income housing program?” Those responding “no” were defined as market-rate housing residents. Responses of “don't know” or “refused” were excluded.

Two questions determined the respondent's smoking status (current smoker vs. current non-smoker): (1) "Have you smoked at least 100 cigarettes in your lifetime?" and, if yes, (2) "Do you now smoke cigarettes every day, some days, or not at all?". Those answering "yes" to question (1) and either "some days" or "every day" to question (2) were defined as current smokers. Current non-smokers included both never smokers ("no" to question (1)) and former smokers ("yes" to question (1) and "not at all" to question (2)).

Other covariates included age (18-24 years, 25-64 years, 65+ years), sex (male, female), race/ethnicity (White, non-Hispanic, Black, non-Hispanic, Hispanic, Other, or Missing), education (<high school, high school graduate/GED, some college, college graduate or graduate school), type of MUH (apartment style MUH vs. “other” [duplex, double/multi-family home, condominium, or townhouse]), presence of 1+ children under the age of 18 in the home (no, yes), sample type (random digit dial, targeted lists), and knowledge of SHS (continuous, number of questions answered correctly, range: 0 – 10).

Data were analyzed using IBM SPSS version 21. Univariate and bivariate analyses are stratified by community and subsidized housing status. Significance testing for univariate

analyses were calculated using the chi-square test; p-values <0.05 were considered statistically significant.

Binary Logistic Regression within Generalized Linear Mixed Modeling (GLMM) assessed socio-demographic predictors of each outcome of interest overall, and according to subsidized housing status (market rate, subsidized) while accounting for community clustering. Missing data in outcomes or predictor variables were excluded from analyses. Statistical tests for multiplicative interaction between subsidized housing status and smoking status were completed to assess whether non-smokers residing in subsidized housing experienced more SHS incursions into their living unit compared to non-smokers residing in market-rate housing.

Weighting Procedures

Community-specific post-stratification weights were developed from Public Use Microdata Areas (PUMAs).[31] For each community, PUMA housing and person data were obtained for individuals aged 18 and over who resided in MUH. The frequency distributions for age, sex, and race/ethnicity of the PUMA data in each community were used to construct weights that were applied to the data for all univariate and bivariate analyses. In lieu of applying weights to the multivariate analyses (GLMM), the covariates used in the construction of the weights (age, sex, and race/ethnicity) were included in the models as independent variables.

Results

Across all communities, 1,565 interviews were obtained. Weighted demographic characteristics of MUH residents overall and stratified by community are reported in Table 1. The proportion of current smokers ranged from 23% (GF) to 34% (CO).

Between 20% (FC) and 39% (PB) of residents lived in subsidized housing, and over half of residents in four communities (PB, CO, BM and GF) had annual household incomes below \$30,000. Racial and ethnic characteristics varied by community but were consistent between community pairs.

Voluntary Smoke-free Home Rules

The prevalence of each outcome stratified by community and subsidized housing status is reported in Table 2. Voluntary smoke-free home rules were reported by 76% of all respondents, ranging from 64% (CH) to 95% (FC) by community. Only 10% of respondents allowed smoking inside their unit without any restrictions (range: 1.3% (FC) to 15% (CO)). A significantly higher proportion of market-rate housing residents enforced voluntary smoke-free home rules compared to subsidized housing residents overall (82% vs. 69%, $p<0.001$) and within each community.

In multivariate modeling overall, non-smokers were significantly more likely to report enforcing smoke-free home rules compared to current smokers (Odds Ratio (OR) =14.73, 95% CI: 10.25-21.17; Table 3). Residents of subsidized housing were about 30% less likely to enforce smoke-free home rules, though this was marginally non-significant (OR=0.70, 95% CI: 0.49-1.002; Table 3). In analyses restricted to market-rate housing residents, those

with children in the home were 4 times more likely to enforce voluntary smoke-free home policies (OR=4.18, 95% CI: 1.99-8.79) compared to those without children. Among subsidized housing residents, higher odds of smoke-free home rules were observed for females (OR=2.18, 95% CI: 1.19-3.98) and those with a college education (OR=3.58, 95% CI: 1.18-10.87).

Rules about Smoking in the Building

Twenty-three percent (23.4%) of all respondents reported living in a smoke-free building, but most (67.3%) reported having no rules about smoking inside the building where they lived (Table 2). Smoke-free building rules ranged from 6.4% (CO) to >40% (BM, GF) in community stratified analyses. Overall, smoke-free building policies were more common among residents of market-rate housing compared to those in subsidized housing though differences were noted in community-stratified analyses.

In multivariable modeling, no differences in smoke-free building policies were observed according to subsidized housing status (Table 3). Overall, non-smokers were nearly twice as likely to live in a smoke-free building compared to current smokers (OR=1.94, 95% CI: 1.32-2.84; Table 3), and similar associations were observed in analyses stratified by subsidized housing status (Table 4). Market-rate housing residents with children in the home were twice as likely to live in a smoke-free building (OR=2.26, 95% CI: 1.38-3.76; Table 4). Non-apartment style MUH residents were significantly less likely to reside in a smoke-free building, but this association persisted only among market-rate housing residents in stratified analyses (OR=0.35 (95% CI: 0.25-0.51; Table 4).

SHS Incursions

Approximately 50% of residents who enforce smoke-free home rules reported experiencing a SHS incursion into their unit from somewhere else in or around the building, ranging from 34% (CH) to over 75% (FC) in community-stratified analyses (Table 2).

In multivariable modeling, no main effects of SHS incursions were observed according to smoking status or subsidized housing status (Table 3). However, there is suggestive evidence ($p=0.18$) of an interaction between smoking and subsidized housing status on experiencing SHS incursions, in which non-smokers residing in subsidized housing had increased odds of reporting SHS incursions (OR=1.8, 95% CI: 0.8-4.5; not shown) compared to non-smokers residing in market-rate housing. Overall, higher odds of experiencing SHS incursions into the unit were observed among Hispanic respondents (OR=1.79, 95% CI: 1.04-3.09) and females (OR=1.47, 95% CI: 1.10-1.95). Residents of non-apartment style MUH buildings (OR=0.72, 95% CI: 0.54-0.96) and older individuals (65+; OR=0.46, 95% CI: 0.22-0.93) were both less likely to report incursions (Table 3).

Respondents who lived in a smoke-free building had significantly reduced odds of reporting SHS incursions into their unit compared to those who lived in a smoke-permitted building (OR=0.59, 95% CI: 0.44-0.80; Table 3). Although market-rate housing residents also experienced reduced odds of SHS exposure due to smoke-free building policies (OR=0.50, 95% CI: 0.35-0.71, Table 4), there was no difference in SHS incursions according to smoke-free building status among residents of subsidized housing.

Preferences for Smoke-free Building Policies

Over half (56%) of respondents who reside in smoking-allowable buildings reported they would prefer to have a policy in their building that prohibited smoking in all areas (range: 45% (PB) to 68% (GF); Table 2). Preferences for smoke-free policies did not differ according to subsidized housing status overall but community-specific differences were observed (Table 2). Over 90% of residents already living in a smoke-free building reported preferences toward smoke-free building policies (data not shown).

In multivariable-adjusted analyses, non-smokers were significantly more likely to report preferences toward smoke-free building policies overall (OR=5.80, 95% CI: 3.99-8.45; Table 3) and in analyses stratified by subsidized housing (Table 4). Those with children in the home were about 70% more likely to prefer a smoke-free building policy (OR=1.68, 95% CI: 1.05-2.68; Table 3). In analyses restricted to market-rate housing, non-apartment style MUH residents were 40% less likely to prefer a smoke-free building policy (OR=0.58, 95% CI: 0.40-0.84; Table 4) compared to apartment dwellers.

Discussion

Despite enforcing smoke-free home rules, half of MUH residents reported experiencing SHS incursions into their personal living space, indicating that personal smoke-free home rules do not confer full protection from SHS exposures in smoking-allowable MUH buildings. [16-19] Although the majority of residents reported they would prefer to have a policy inside their building that prohibited smoking in all location, only about 25% actually lived in a building with a policy, suggesting a disconnect between preferences and availability of smoke-free living environments. Despite variation in smoke-free building rules and external influences of community-level tobacco control policies, preferences toward smoke-free policies were generally consistent across communities and with previously reported estimates.[28,29]

Higher smoking rates and SHS exposures persist among populations with lower socioeconomic indicators.[11,12] This study found evidence to suggest that non-smokers living in subsidized housing may have higher SHS exposures in their homes compared to non-smokers living in market-rate housing. Furthermore, the relationship between smoking status and preferences toward smoke-free policies was stronger among residents of subsidized housing, suggesting that in addition to the greater need for smoke-free policies in subsidized housing, there may also be higher demand for smoke-free policies in this environment.

Although clean indoor air legislation in Colorado and North Dakota prohibits smoking in common-use areas of MUH buildings,[32,33] a sizable proportion of residents in these states reported that smoking was allowed “anywhere, or at any time” inside their building, suggesting a lack of enforcement and a need to educate residents and building operators about these MUH-specific smoking restrictions. Our data also found that subsidized housing residents in these states were more aware of the smoking restrictions inside their building. This may suggest that subsidized housing operators are enforcing these rules more

effectively, possibly due to the presence of other regulations and minimum standards that are linked to their ability to receive and maintain funding.

The extent of state- or community-level tobacco control policies may influence perceptions toward SHS exposures in the home environment. For example, residents living in states without comprehensive clean indoor air legislation may become desensitized to tobacco smoke exposures occurring inside their homes due to more frequent exposures in public places. In the current study, South Carolina MUH residents reported the fewest SHS incursions into their units, despite having the lowest prevalence of smoke-free building policy coverage. Although community-level policies were present in both Charleston and Columbia, SC, this discrepancy in SHS exposures in the home may have been influenced by the lack of a comprehensive smoke-free air policy at the state level.[34]

Among residents of market-rate housing, non-smokers and those with children in the home were more likely to reside in a smoke-free building, suggesting that specific populations may be seeking out smoke-free living environments. However, financial constraints and housing availability may limit the ability of subsidized housing residents to seek out smoke-free housing. In this study, market-rate housing residents were also more likely to enforce voluntary smoke-free home rules when children were present in the home, while no association was observed among residents of subsidized housing. Therefore, in addition to SHS exposures from in or around the building, children living in subsidized housing may also experience SHS exposures originating from active smoking inside their unit. These socio-economic disparities in protection from SHS exposures underscore the importance of continued work to encourage or mandate subsidized and public housing providers to implement smoke-free building policies.

Results of this study suggest that individuals residing in non-apartment style MUH, such as townhouses or condominiums, may have different experiences with SHS in their homes due to varying building structures that could influence their attitudes towards smoke-free building policies. Residents of non-apartment style MUH reported fewer SHS incursions, lower preferences toward smoke-free building policies, as well as fewer smoke-free building rules compared to apartment-style MUH. A higher proportion of residents living in townhouses or condominiums may own their units compared to apartment-style MUH residents, which may impact attitudes regarding individuals' rights to smoke inside these personal living spaces. Additionally, it may be comparatively more difficult to adopt smoke-free policies in these MUH environments, because modifications to existing rules may require approvals by homeowners' association and resident advisory boards.[35] Public health personnel need to be aware of these important differences when working with non-traditional MUH communities to effectively encourage smoke-free policy adoption.

This study is not without limitations. As this study was defined to 6 U.S. communities, the results may not be generalizable to other populations, particularly in regions not represented in this study. Second, because MUH residents are a difficult segment of the population to reach using population-based sampling (RDD), it was necessary to use targeted renter lists to increase the efficiency of data collection. Respondents identified using the targeted lists tended to be older, have lower annual household incomes, and reside in subsidized housing

compared to the RDD respondents. To compensate for these issues, we've weighted our data analyses to be more representative of the populations from which the samples were drawn. Although low, our RDD response rate (32%) was similar to that calculated for a national RDD survey of MUH residents.[28] However, this points to a need to adopt dual-method or non-population based data collection procedures to identify MUH populations in the future, such as the utilization of targeted lists, address-based sampling procedures (including door-to-door surveys),[27] or the integration of internet panels.[29] Finally, our outcomes are based on self-report. MUH residents may overestimate the rules about smoking inside their building,[25] or there may be inter-individual differences in the ability to detect SHS exposures occurring inside one's home. However, our findings were largely consistent between community pairs, suggesting that any differences would be consistent in larger geographic regions (i.e. at the state level). Additionally, the main goal of this study overall is to assess changes over time within respondents, so any misclassification from this baseline survey is likely to continue through follow-up.

Conclusions

Enforcement of smoke-free home rules does not adequately protect MUH residents from SHS exposures inside their homes, particularly in subsidized MUH environments. Strong preferences for smoke-free policies were observed among all MUH residents, though subsidized housing residents may have fewer housing options available to seek out alternative smoke-free living environments. Due to these disparities, all publically funded housing should be required to implement smoke-free building policies in order to protect these vulnerable populations. However, efforts to encourage privately owned MUH buildings to adopt smoke smoke-free policies should also continue.

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What This Paper Adds

Secondhand smoke (SHS) can move throughout a multiunit housing (MUH) building, entering into spaces where tobacco smoking is otherwise prohibited. Although clean indoor air legislation has contributed to reductions in SHS exposure over time, the magnitude of this decline has been smaller for lower socio-economic groups. To date, most of the MUH literature has focused on the attitudes and experiences with SHS and smoke-free policies among subsidized or market-rate housing residents, exclusively. The current study, however, compares the experiences with SHS and smoke-free policies between these MUH populations. Results show that market-rate housing residents had significantly higher odds of protection from SHS through smoke-free home and building rules, particularly when children were present in the home, while no association was observed for either outcome among subsidized housing residents. Non-smoking subsidized housing residents exhibited stronger preferences for smoke-free building policies, but may have fewer opportunities to seek out smoke-free living environments, providing support for mandated smoke-free policies in all subsidized housing.

Figure 1. Completed Interviews, Response Rates, and Participation Rates by Data Source
 AAPOR RR#3 = American Association of Public Opinion Research, Response Rate calculator #3: accounts for ineligible records within the denominator and estimates how many cases of unknown eligibility are likely to be actually eligible.[30] Participation rates were calculated for the listed samples; all records of unknown eligibility were assumed to be eligible and are included in the denominator for these calculations.

Table 1
Socio-Demographic Characteristics of 1,565 MUH Residents in 6 Communities across the United States, 2012

Characteristic	Overall (n=1565)	Columbia (n=358)	Charleston (n=318)	Grand Forks (n=196)	Bismarck (n=271)	Fort Collins (n=227)	Pueblo (n=195)	p value
Housing Status Type								
Subsidized Housing	459 (25.8%)	109 (25.4%)	104 (21.5%)	56 (26.9%)	56 (26.4%)	62 (20.4%)	72 (38.5%)	<0.001
Market-Rate Housing	1068 (74.2%)	236 (74.6%)	210 (78.5%)	135 (73.1%)	210 (73.6%)	162 (79.6%)	115 (61.5%)	
Smoking Status								
Never User	731 (48.3%)	166 (50.0%)	140 (49.5%)	98 (57.5%)	138 (43.3%)	107 (46.5%)	82 (42.4%)	0.02
Former User	503 (21.8%)	107 (16.5%)	98 (22.4%)	51 (19.2%)	96 (25.2%)	87 (25.4%)	64 (24.6%)	
Current User (every, some days)	1554 (29.9%)	84 (33.5%)	78 (28.1%)	43 (23.3%)	35 (31.5%)	33 (28.1%)	47 (33.0%)	
Child <18 years in household (% yes)								
	197 (16.9%)	64 (24.9%)	37 (14.2%)	24 (11.8%)	20 (13.1%)	25 (13.2%)	27 (21.8%)	<0.001
Sex (% Female)								
	1043 (42.9%)	238 (39.8%)	230 (47.2%)	118 (44.9%)	184 (43.2%)	149 (34.8%)	124 (48.5%)	0.027
Age								
18-24 years	68 (30.4%)	11 (32.5%)	10 (30.3%)	14 (26.7%)	13 (30.7%)	5 (38.8%)	15 (20.3%)	<0.001
25-64 years	791 (58.8%)	214 (61.6%)	170 (62.8%)	108 (51.8%)	101 (53.3%)	106 (56.4%)	92 (65.1%)	
65+ years	701 (10.8%)	132 (5.9%)	137 (6.9%)	73 (21.5%)	157 (15.9%)	116 (4.8%)	86 (14.6%)	
MUH type								
Apartment	1105 (66.7%)	271 (73.1%)	232 (55.3%)	143 (69.9%)	187 (64.2%)	131 (69.2%)	141 (71.3%)	<0.001
Other MUH Type	460 (33.3%)	87 (26.9%)	86 (44.7%)	53 (30.1%)	84 (35.8%)	96 (30.8%)	54 (28.7%)	
Race								
Non-Hispanic White	1010 (54.8%)	127 (27.7%)	163 (42.6%)	166 (88.3%)	248 (75.6%)	203 (68.0%)	103 (47.2%)	<0.001
Non-Hispanic Black	344 (21.4%)	193 (61.9%)	138 (30.3%)	8 (7.1%)	0 (0.0%)	1 (0.9%)	4 (1.0%)	
Hispanic	125 (15.7%)	18 (5.3%)	4 (21.8%)	1 (1.0%)	7 (1.1%)	13 (24.1%)	82 (49.7%)	
Non-Hispanic, Other	59 (7.1%)	11 (3.6%)	10 (5.6%)	17 (2.0%)	12 (22.6%)	6 (6.1%)	3 (1.0%)	
Missing	27 (1.0%)	9 (1.4%)	3 (0.0%)	4 (1.5%)	4 (0.7%)	4 (0.9%)	3 (1.0%)	
Education								

Characteristic	Overall (n=1565)	Columbia (n=358)	Charleston (n=318)	Grand Forks (n=196)	Bismarck (n=271)	Fort Collins (n=227)	Pueblo (n=195)	p value
Less than high school	156 (8.8%)	46 (11.2%)	44 (7.3%)	11 (3.6%)	32 (14.6%)	7 (4.4%)	16 (8.7%)	<0.001
High School Grad/GED	436 (31.3%)	88 (28.1%)	81 (31.2%)	62 (33.8%)	89 (29.9%)	43 (24.7%)	73 (44.6%)	
Some College/Tech School	344 (24.3%)	84 (23.6%)	68 (29.7%)	40 (26.7%)	54 (20.1%)	51 (19.4%)	47 (26.2%)	
College/Tech School Grad	414 (25.7%)	104 (29.5%)	81 (21.1%)	53 (22.1%)	67 (26.9%)	70 (37.4%)	39 (14.4%)	
Graduate or Professional School	205 (10.0%)	34 (7.6%)	41 (10.7%)	28 (13.8%)	26 (8.6%)	56 (14.1%)	20 (6.2%)	
Annual Household Income								
\$29,999	838 (49.0%)	199 (57.0%)	172 (40.7%)	98 (52.6%)	147 (55.0%)	96 (23.3%)	126 (65.6%)	<0.001
\$30,000 - \$59,999	341 (30.0%)	96 (27.9%)	62 (33.1%)	48 (25.0%)	56 (21.8%)	51 (53.7%)	28 (17.9%)	
\$60,000	155 (11.3%)	24 (5.6%)	33 (15.1%)	21 (9.2%)	29 (17.7%)	40 (15.4%)	8 (4.1%)	
Don't Know or Missing	231 (9.6%)	39 (9.5%)	51 (11.0%)	29 (13.3%)	39 (5.5%)	40 (7.5%)	33 (12.3%)	

N's represent unweighted distributions; percentages are weighted to the age, race, and gender within each community. The number of respondents in each category may not add up to column totals due to missing data (except for "annual household income" and "race", which include a category for missing data).

P values compare the proportion of each characteristic present by community using chi-square analysis (completed on weighted data). P-values <0.05 are considered statistically significant (bolded).

Table 2
Prevalence of Voluntary Smoke-free Home Rules, SHS Incursions, Rules about Smoking in the Building, and Preferences for Smoke-free Policies among MUH Residents Living in 6 communities across the U.S.: Overall and Stratified by Public/Affordable Housing vs. Market-Rate Housing

Outcome	Overall (n=1,565)	Columbia (n=358)	Charleston (n=318)	Grand Forks (n=196)	Bismarck (n=271)	Fort Collins (n=227)	Pueblo (n=195)
Voluntary Rules – smoking in home							
Does not all smoking anywhere	1259 (76.0%)	263 (70.6%)	244 (63.7%)	159 (82.6%)	245 (81.9%)	205 (95.1%)	143 (68.2%)
Allows smoking anywhere (any time)	148 (9.5%)	53 (14.6%)	40 (13.9%)	13 (5.6%)	12 (5.5%)	8 (1.3%)	22 (12.3%)
Allows smoking in some places/times	146 (14.5%)	41 (14.6%)	33 (22.4%)	22 (11.8%)	10 (12.5%)	11 (3.5%)	29 (19.5%)
SHS incursions (unit), past 12 months (% ever)^b	522 (49.9%)	121 (45.8%)	82 (33.5%)	69 (39.4%)	99 (53.8%)	89 (75.1%) #	62 (47.7%)
Rules about smoking in the building							
No rules about smoking in building	866 (67.3%)	251 (86.7%)	220 (88.3%)	76 (41.2%)	111 (50.8%)	107 (57.1%)	101 (53.9%)
Smoking prohibited in shared areas	195 (9.3%)	44 (7.0%)	30 (4.3%)	40 (18.7%)	30 (7.8%)	21 (8.7%)	30 (15.6%)
Smoking prohibited in all areas	383 (23.4%)	38 (6.4%)	41 (7.3%)	66 (40.1%)	108 (41.5%)	78 (34.2%)	52 (30.6%)
Preference: smoke-free building policy (% yes)^c	603 (56.4%)	162 (56.3%)	143 (63.7%)	72 (68.0%)	95 (51.0%)	68 (46.6%)	63 (45.3%)
Public/Affordable (Subsidized) Housing (n=459)^a							
Voluntary Rules – smoking in home							
Does not all smoking anywhere	339 (59.5%)	79 (56.2%)	72 (55.4%)	38 (60.8%)	47 (48.6%)	53 (89.1%)	50 (58.3%)
Allows smoking anywhere (any time)	55 (12.7%)	12 (9.0%)	18 (27.7%)	8 (13.7%)	4 (9.7%)	4 (0.0%)	9 (13.9%)
Allows smoking in some places/times	64 (27.8%)	18 (34.8%)	13 (16.9%)	10 (25.5%)	5 (41.7%)	5 (10.9%)	13 (27.8%)

Outcome	Overall (n=1,565)	Columbia (n=358)	Charleston (n=318)	Grand Forks (n=196)	Bismarck (n=271)	Fort Collins (n=227)	Pueblo (n=195)
SHS incursions (unit), past 12 months (% ever)^b	148 (51.9%)	39 (49.0%)	25 (37.1%)	21 (54.8%)	21 (58.8%)	21 (63.2%) [#]	21 (46.3%)
Rules about smoking in the building							
No rules about smoking in building	213 (62.5%)	59 (84.9%)	71 (84.1%)	19 (41.7%)	21 (72.1%)	14 (25.0%)	29 (43.3%)
Smoking prohibited in shared areas	98 (16.0%)	28 (10.5%)	12 (9.5%)	17 (31.3%)	12 (10.3%)	12 (13.6%)	17 (25.4%)
Smoking prohibited in all areas	120 (21.5%)	18 (4.7%)	12 (6.3%)	16 (27.1%)	18 (17.6%)	33 (61.4%)	23 (31.3%)
Preference: smoke-free building policy (% yes)^c	177 (52.9%)	51 (69.1%)	50 (57.9%)	20 (65.7%)	21 (25.5%)	14 (66.7%)	21 (35.6%)
Market-Rate Housing (n=1,068)^a							
Voluntary Rules – smoking in home							
Does not all smoking anywhere	888 (82.0%)	174 (76.6%)	168 (65.3%)	116 (90.7%)	193 (93.9%)	149 (96.7%)	88 (75.9%)
Allows smoking anywhere (any time)	90 (8.3%)	39 (16.5%)	22 (10.6%)	5 (2.1%)	8 (4.1%)	4 (1.7%)	12 (9.5%)
Allows smoking in some places/times	80 (9.7%)	22 (6.9%)	20 (24.1%)	12 (7.1%)	5 (2.0%)	6 (1.7%)	15 (14.7%)
SHS incursions (unit), past 12 months (% ever)^b	366 (49.6%)	80 (45.7%)	55 (31.3%)	46 (35.7%)	77 (53.0%)	68 (78.2%) [#]	40 (48.3%)
Rules about smoking in the building							
No rules about smoking in building	635 (69.1%)	184 (88.4%)	147 (89.2%)	55 (41.2%)	89 (43.4%)	92 (69.6%)	69 (59.8%)
Smoking prohibited in shared areas	94 (6.4%)	15 (4.8%)	18 (3.0%)	22 (13.7%)	17 (6.3%)	9 (6.1%)	13 (9.3%)
Smoking prohibited in all areas	253 (24.4%)	17 (6.8%)	28 (7.8%)	49 (45.0%)	89 (50.3%)	26 (24.3%)	26 (30.8%)
Preference: smoke-free building policy (% yes)^c	412 (57.9%)	107 (53.0%)	92 (65.1%)	49 (68.8%)	73 (67.8%)	53 (43.0%)	38 (47.8%)

Outcome	Overall (n=1565)	Columbia (n=358)	Charleston (n=318)	Grand Forks (n=196)	Bismarck (n=271)	Fort Collins (n=227)	Pueblo (n=195)
Overall (n=1,565)							
Subsidized vs. Market-Rate Comparison^d							
Voluntary rules – smoking in home	P<0.001	P<0.001	P=0.002	P<0.001	P<0.001	P=0.008	P=0.036
SHS incursions into unit (past 12 months)	p=0.712	p=0.750	p=0.551	p=0.065	p=0.578	p=0.062	p=0.852
Rules about smoking in the building	p<0.001	p=0.146	p=0.081	p=0.013	p<0.001	p<0.001	p=0.012
Preferences, smoke-free building policies	p=0.143	p=0.013	p=0.353	p=0.824	p<0.001	p=0.076	p=0.244

Analyses (%'s; p-values) are weighted to the age, sex, and race/ethnicity of MUH residents in each community. N's represent unweighted data. Missing data (don't know, refusals) from outcomes are excluded (Number missing overall from each outcome: Voluntary Rules: n=12; SHS Incursions: n=13; Rules about smoking in the building: n=121; Preferences: smoke-free building policy: n=41)

^a n=38 were missing data on public/affordable housing status and are excluded from stratified analyses.

^b vs. "never"; SHS Incursion analyzed among MUH residents with voluntary smoke-free home rules (unweighted n=1,259; public/affordable: n=339; market-rate: n=888)

^c vs. "no"; Preferences analyzed among MUH residents who reside in smoking-allowable buildings, only (unweighted n=1,061; public/affordable: n=311; market-rate: n=729)

There was a statistically significant difference by community for each outcome based on χ^2 analysis (p<0.05) except for the comparison of "Yes – SHS incursion into unit in past 12 months" by community among Public/Affordable Housing (p=0.271; other p-values not shown).

^d p-values comparing the outcome by public/affordable or market-rate housing status within each community are provided in the table.

Table 3
Demographic Predictors of MUH Residents reporting each Outcome of Interest in 6 Communities across the U.S

Characteristics	Voluntary Smoke-free Home		Live in Smoke-free Building		SHS Incursion (past 12 mo.)*		Prefer Smoke-free Building**	
	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)
Smoking Status								
Current Smoker	49.1%	1.0	15.2%	1.0	60.8%	1.0	30.9%	1.0
Current Non-Smoker	87.4%	14.73 (10.25-21.17)	26.9%	1.94 (1.32-2.84)	47.3%	0.87 (0.57-1.32)	68.7%	5.80 (3.99-8.45)
Housing Status Type								
Market-rate housing	81.9%	1.0	24.5%	1.0	49.6%	1.0	57.8%	1.0
Subsidized housing	59.2%	0.70 (0.49-1.002)	21.4%	1.06 (0.78-1.43)	51.1%	1.00 (0.74-1.35)	52.8%	1.15 (0.80-1.63)
Child <18 yr. in HH								
No	73.9%	1.0	24.0%	1.0	50.4%	1.0	55.4%	1.0
Yes	84.5%	3.08 (1.76-5.40)	21.6%	1.52 (0.97-2.37)	48.4%	1.03 (0.70-1.52)	61.9%	1.68 (1.05-2.68)
MUH Type								
Apartment Style	75.5%	1.0	25.8%	1.0	51.7%	1.0	50.9%	1.0
Other MUH	76.5%	0.90 (0.62-1.32)	19.2%	0.38 (0.28-0.53)	46.3%	0.72 (0.54-0.96)	66.1%	0.74 (0.53-1.03)
Race								
White, non-Hispanic	84.0%	1.0	33.0%	1.0	49.1%	1.0	53.3%	1.0
Black, non-Hispanic	69.0%	0.93 (0.58-1.49)	5.0%	0.56 (0.34-0.92)	39.7%	1.19 (0.81-1.76)	61.7%	1.36 (0.89-2.07)
Hispanic	64.5%	0.73 (0.39-1.35)	15.3%	0.84 (0.48-1.47)	61.5%	1.79 (1.04-3.09)	69.5%	1.31 (0.70-2.45)
Other Race	59.5%	0.81 (0.34-1.91)	24.1%	0.63 (0.30-1.30)	71.9%	1.94 (0.96-3.92)	26.0%	0.91 (0.41-2.04)
Missing	68.8%	0.72 (0.21-2.51)	21.4%	1.84 (0.69-4.88)	20.0%	0.97 (0.35-2.74)	72.7%	3.41 (0.81-14.33)
Education								
<High school education	53.3%	1.0	24.2%	1.0	45.7%	1.0	54.8%	1.0
High school Graduate/GED	76.4%	1.07 (0.61-1.88)	24.7%	0.75 (0.45-1.24)	47.8%	0.93 (0.55-1.56)	57.8%	0.84 (0.46-1.54)
Some College	69.4%	1.46 (0.81-2.64)	23.4%	0.72 (0.43-1.22)	51.7%	0.75 (0.44-1.29)	62.5%	0.94 (0.50-1.75)
College Graduate	84.5%	1.61 (0.88-2.95)	22.3%	0.60 (0.36-1.02)	49.9%	0.68 (0.40-1.15)	50.0%	0.78 (0.42-1.46)
Graduate School	87.7%	1.45 (0.70-2.97)	22.2%	0.53 (0.29-0.97)	53.3%	0.80 (0.44-1.43)	56.5%	0.86 (0.43-1.72)

Characteristics	Voluntary Smoke-free Home		Live in Smoke-free Building		SHS Incursion (past 12 mo.) [*]		Prefer Smoke-free Building ^{**}	
	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)	% (yes)	OR (95% CI)
Sex								
Male	70.3%	1.0	54.8%	1.0	47.4%	1.0	52.6%	1.0
Female	83.3%	1.28 (0.91-1.79)	24.4%	0.92 (0.69-1.23)	52.5%	1.47 (1.10-1.95)	61.4%	1.18 (0.86-1.61)
Age								
18-24 years	73.6%	1.0	26.8%	1.0	55.9%	1.0	64.9%	1.0
25-64 years	75.4%	0.77 (0.35-1.68)	19.6%	0.36 (0.19-0.68)	50.7%	1.01 (0.51-1.99)	51.0%	0.55 (0.24-1.25)
65+ years	83.9%	0.69 (0.30-1.61)	36.6%	0.69 (0.35-1.37)	30.7%	0.46 (0.22-0.93)	69.1%	0.71 (0.30-1.70)
Sample Type								
RDD population based	82.3%	1.0	34.9%	1.0	53.4%	1.0	50.0%	1.0
Targeted Lists	73.2%	0.82 (0.50-1.36)	18.6%	0.85 (0.57-1.27)	48.3%	0.87 (0.59-1.28)	58.6%	1.41 (0.89-2.24)
Knowledge Score^{***}								
No	7.03 (2.6)		7.76 (2.2)	1.05 (0.99-1.12)	8.07 (2.0)		7.02 (2.4)	
Yes	8.14 (2.0)	1.22 (1.14-1.30)	8.41 (1.8)		8.23 (2.0)	1.13 (1.05-1.21)	8.33 (1.9)	1.37 (1.27-1.48)
Live in a smoke-free building								
No	n/a	n/a	n/a	n/a	45.0%	1.0	n/a	n/a
Yes					49.9%	0.59 (0.44-0.80)		

Proportions (%) are weighted to the age, sex, and race/ethnicity of MUH residents in each community. GLMM models are unweighted, but are adjusted for age, race, and sex.

^{*} vs. those answering "never" in past 12 months; SHS Incursion outcome analyzed among MUH residents who report having voluntary smoke-free home rules (unweighted n=1,259)

^{**} Preference outcome analyzed among MUH residents who reside in smoking-allowable buildings, only (unweighted n=1,061)

^{***} Knowledge score; presents the mean number of questions answered correctly out of 10 for those reporting each outcome. (Parentheses) provides the standard deviation. In models, entered as a continuous variable.

OR = Odds Ratio; CI = Confidence Interval. GED = General Educational Development exam; MUH = Multiunit Housing; HH = Household ; RDD = Random Digit Dial;

OR and CI's based on Binary Logistic Regression within Generalized Linear Mixed Modeling, accounting for community clustering.

Demographic Predictors of MUH Residents reporting each Outcome in 6 Communities across the U.S.: Stratified by Subsidized Housing Status

Table 4

		Voluntary Smoke-free Home Rules		Live in Smoke-free Building		SHS Incursion (past 12 mo.)*		Prefer Smoke-free Building**	
Characteristics		Market-rate (n=1044)	Subsidized (n=439)	Market-rate (n=969)	Subsidized (n=413)	Market-rate (n=803)	Subsidized (n=295)	Market-rate (n=691)	Subsidized (n=288)
Smoking Status									
Current Smoker		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Current Non-Smoker		15.97 (9.92-25.41)	14.27 (7.78-26.18)	1.93 (1.19-3.13)	1.95 (0.99-3.86)	0.77 (0.47-1.26)	1.17 (0.52-2.64)	5.17 (3.25-8.21)	8.94 (4.40-18.17)
Child <18 yr. in HH									
No		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Yes		4.18 (1.99-8.79)	1.89 (0.69-5.22)	2.26 (1.38-3.76)	0.32 (0.09-1.19)	1.03 (0.66-1.60)	1.03 (0.41-2.57)	1.72 (1.00-2.96)	2.02 (0.71-5.72)
MUH Type									
Apartment Style		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Other MUH		0.89 (0.58-1.37)	1.12 (0.47-2.70)	0.35 (0.25-0.51)	0.62 (0.26-1.45)	0.68 (0.49-0.93)	0.86 (0.41-1.80)	0.58 (0.40-0.84)	2.00 (0.80-5.00)
Race									
White, non-Hispanic		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Black, non-Hispanic		0.69 (0.38-1.23)	1.28 (0.60-2.75)	0.38 (0.20-0.75)	0.80 (0.37-1.71)	0.89 (0.55-1.42)	1.64 (0.88-3.03)	1.15 (0.69-1.90)	1.62 (0.79-3.33)
Hispanic		0.58 (0.27-1.27)	0.98 (0.34-2.82)	0.60 (0.28-1.27)	1.19 (0.46-3.07)	1.98 (1.00-3.93)	1.57 (0.65-3.82)	1.07 (0.50-2.26)	1.27 (0.41-3.94)
Other Race		1.00 (0.32-3.10)	0.63 (0.15-2.72)	1.08 (0.47-2.48)	0.12 (0.01-1.11)	1.71 (0.77-3.79)	3.79 (0.69-21.48)	2.25 (0.73-6.90)	0.29 (0.07-1.29)
Missing		0.95 (0.22-4.04)	0.61 (0.05-7.90)	1.99 (0.70-5.65)	1.72 (0.07-44.84)	0.82 (0.27-2.51)	5.30 (0.29-97.98)	2.90 (0.66-12.84)	N/A
Education									
<High school education		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
HS graduate/GED		1.33 (0.58-3.06)	0.88 (0.39-2.00)	0.59 (0.29-1.20)	0.95 (0.45-2.00)	1.03 (0.52-2.07)	0.84 (0.37-1.89)	10.5 (0.44-2.49)	0.56 (0.22-1.40)
Some College		2.06 (0.86-4.91)	1.13 (0.48-2.65)	0.71 (0.34-1.48)	0.63 (0.28-1.41)	0.84 (0.41-1.70)	0.77 (0.33-1.81)	1.13 (0.47-2.76)	0.68 (0.26-1.76)
College Graduate		1.50 (0.66-3.43)	3.58 (1.18-10.87)	0.53 (0.26-1.07)	0.62 (0.24-1.54)	0.60 (0.30-1.19)	1.19 (0.49-2.89)	0.93 (0.40-2.18)	0.71 (0.24-2.06)
Graduate School		1.50 (0.60-3.77)	2.75 (0.58-12.99)	0.36 (0.17-0.79)	1.74 (0.54-5.37)	0.72 (0.34-1.50)	1.56 (0.49-4.95)	1.09 (0.45-2.69)	0.68 (0.14-3.38)
Sex									
Male		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

		Voluntary Smoke-free Home Rules		Live in Smoke-free Building		SHS Incursion (past 12 mo.) [*]		Prefer Smoke-free Building ^{**}	
Characteristics		Market-rate (n=1044)	Subsidized (n=439)	Market-rate (n=969)	Subsidized (n=413)	Market-rate (n=803)	Subsidized (n=295)	Market-rate (n=691)	Subsidized (n=288)
Female		0.98 (0.64-1.51)	2.18 (1.19-3.98)	0.91 (0.64-1.30)	0.96 (0.56-1.66)	1.51 (1.08-2.11)	1.45 (0.82-2.59)	1.33 (0.92-1.94)	0.79 (0.41-1.52)
Age									
18-24 years		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25-64 years		0.62 (0.23-1.69)	1.80 (0.36-9.03)	0.39 (0.18-0.85)	0.22 (0.05-0.99)	1.23 (0.59-2.59)	0.6 (0.06-3.31)	0.46 (0.17-1.22)	0.44 (0.07-2.64)
65+ years		0.47 (0.16-1.38)	2.25 (0.41-12.32)	0.66 (0.29-1.49)	0.54 (0.12-2.50)	0.50 (0.23-1.11)	0.24 (0.03-1.76)	0.71 (0.26-1.95)	0.42 (0.06-2.79)
Sample Type									
RDD population based		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Targeted Lists		0.83 (0.44-1.54)	0.74 (0.27-2.00)	0.84 (0.52-1.34)	0.87 (0.36-2.09)	0.82 (0.53-1.28)	1.01 (0.42-2.56)	1.17 (0.68-2.01)	2.41 (0.88-6.58)
Knowledge Score ^{***}		1.26 (1.15-1.37)	1.18 (1.05-1.33)	1.05 (0.97-1.14)	1.08 (0.96-1.22)	1.12 (1.03-1.22)	1.17 (1.03-1.34)	1.40 (1.28-1.53)	1.35 (1.18-1.54)
Live in smoke-free bldg.									
No		n/a	n/a	n/a	n/a	1.0	1.0	n/a	n/a
Yes						0.50 (0.35-0.71)	0.91 (0.53-1.58)		

^{*} vs. those answering ‘never’, in past 12 months; SHS Incursion outcome analyzed among MUH residents who report having voluntary smoke-free home rules

^{**} Preference outcome analyzed among MUH residents who reside in smoking-allowable buildings, only

^{***} Knowledge score: Models, entered as a continuous variable (score out of 10 answered correctly)

HS = High School GED = General Educational Development exam; MUH = Multituit Housing; HH = Household; RDD = Random Digit Dial. Bldg. = Building. Current smokers: ‘everyday’ and ‘someday’ smokers. Non-Smokers: ‘never’ and ‘former’ smokers. OR and CIs based on Binary Logistic Regression within Generalized Linear Mixed Modeling, accounting for community clustering.