

Disparities in Secondhand Smoke Exposure among Nonsmoking Adults in Rhode Island: Tobacco Control's Pro-Equity Approach

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Secondhand smoke (SHS) is defined as smoke from burning tobacco products.¹ There is no risk-free level of exposure to SHS.² SHS exposure can cause heart disease and lung cancer, resulting in 41,000 deaths each year among nonsmokers.³ SHS exposure increases risk of sudden infant death syndrome and frequency and severity of child asthma attacks.¹ Nonsmokers can be exposed to SHS in public places, worksites, homes, or vehicles. Eliminating SHS is one of four components of state-based tobacco control.⁴ SHS exposure among US nonsmokers declined from 88% in 1988-1991 to 25% in 2011-2012.¹ This is likely attributable to comprehensive smoke-free laws, declining cigarette smoking rates, increased voluntary smoke-free home rules, and changes in social norms. Despite progress, persistent disparities in SHS exposure suggest an unequal public health benefit. Among US nonsmokers, SHS exposure remains higher among children, non-Hispanic blacks, persons in poverty, and renters.³

Rental status functions as a proxy for residence in multiunit housing (MUH) (e.g., apartment, condo).³ Comprehensive smoke-free laws do not cover private settings like the home or multiunit buildings. MUH residents in buildings without smoke-free policies are uniquely susceptible to SHS due to smoke drift from nearby units. Among US multiunit residents with smoke-free home rules, 34% reported involuntary SHS exposure from smoke drifting into their unit.⁵ SHS exposure in subsidized MUH (e.g., Public Housing Authorities [PHAs], affordable housing) is of particular concern because many residents (i.e., disabled, adults with chronic disease, elderly, children) are more sensitive to SHS.⁶ Rhode Island's Tobacco Control Program (RITCP) monitors self-reported SHS exposure to measure compliance to smoke-free laws and inform initiatives that advance tobacco control and health equity. We aimed to 1) examine SHS exposure by three sources among RI nonsmoker adults, 2) examine exposures over time, and 3) identify disparities in exposure.

METHODS

We combined five years (2011-2015) of weighted data from the RI Behavioral Risk Factor Surveillance System (BRFSS) and limited the analytic sample to adults who did not currently smoke cigarettes ($n=25,746$). BRFSS is conducted annually by the RI Department of Health with support from the Centers for Disease Control and Prevention (CDC). BRFSS uses a multistage cluster design based on random digit dialing of landline and cell phones to select a representative sample from each state's non-institutionalized civilian population aged ≥ 18 years.

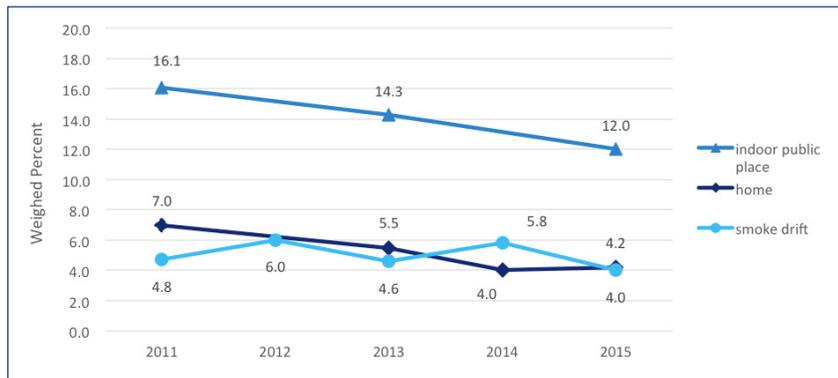
We determined the proportion of nonsmoking adults exposed to SHS by three sources: 1) their home (defined as someone else smoking tobacco in their home during the past 7 days), 2) smoke drift (defined as tobacco smoke drifting into their unit from a smoker in another unit or outside during the past 30 days), and 3) an indoor public place (defined as breathing in smoke from someone else in a public place [e.g., stores, restaurants, bars, casinos, clubs, sports arenas] during the past 7 days, not counting times at work). Each exposure source was cross-tabulated by demographics and housing information. SHS variables were derived from state-added questions asked in varying years from 2011-2015. Smoke drift exposure was asked of adults who reported living in an apartment, condo/townhouse, or duplex. Respondents who reported living in a single-family home were coded as not exposed to smoke drift. Significant differences between groups were determined from non-overlapping confidence intervals (CIs). Analyses were conducted in SAS Version 9.4.

RESULTS

Home exposure among nonsmokers decreased from 7.0% (95% CI=4.6-9.4) in 2011 to 4.2% (95% CI=3.2-5.1) in 2015 (**Figure 1**). Smoke drift exposure among nonsmokers decreased from 4.8% in 2011 (95% CI=3.3-6.3) to 4.0% (95% CI=3.0-4.9) in 2015. Indoor public place exposure among nonsmokers decreased from 16.1% (95% CI=13.5-18.7) in 2011 to 12.0% (95% CI=10.5-13.6) in 2015. Decreases were not significant, but indoor public place exposure approached significance. Smoke drift was additionally examined using only nonsmoking MUH residents as the denominator ($n=5,243$). Prevalence of smoke drift (combined 2011-2015) among MUH residents was 19.5% (**Figure 2**).

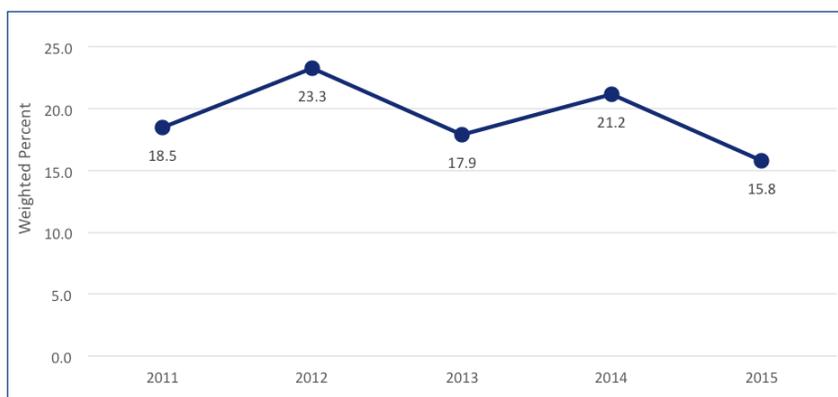
Significant differences were found for exposure source by nonsmoker characteristics (**Table 1**). Home exposure was higher among young adults (18-24), adults with less education (\leq high school), low-income adults (\leq \$25,000) than higher-income adults (\geq \$50,000), and renters versus owners. Smoke drift exposure was higher among young adults (18-24) than older adults (≥ 65), non-Hispanic blacks, Hispanics, and other non-Hispanic race groups compared to whites, low-income adults, adults with less education, and renters. Indoor public place exposure was higher among males, young adults (18-24) than older adults (≥ 45), Hispanic adults than white adults, adults with less education, and low-income adults (\leq \$25,000) than higher-income adults (\geq \$75,000).

Figure 1. Secondhand Smoke Exposure among Nonsmoking RI Adults by Exposure Source, 2011–2015



Data Source: RI 2011–2015 BRFSS. Indoor Public Place asked in odd years; Home not asked in 2012

Figure 2. Smoke Drift Exposure among Nonsmoking RI Adult Multiunit Housing Residents, 2011–2015



Data Source: RI 2011–2015 BRFSS

DISCUSSION

RI has strong smoke-free laws and policies that protect nonsmokers. In 2004, RI was the 7th state to pass a comprehensive smoke-free law banning smoking in indoor public places such as worksites, restaurants, and bars. Comprehensive smoke-free laws reduce heart attack and asthma hospitalizations among nonsmokers, and are one of the most effective tobacco control interventions because they synergistically reduce SHS exposure, change smoking norms, prevent initiation, and promote cessation.^{4,7} Most (23/25) RI PHAs voluntarily adopted smoke-free policies before the recent Housing and Urban Development (HUD) rule requiring PHAs to go smoke-free by July 2018.⁶ Adult smoking declined 23% from 2011–2015,⁸ and 79.4% of Rhode Islanders have voluntary smoke-free home rules.⁹ All of these protective factors contribute to the increasing majority of nonsmokers protected from SHS. From 2011–2015, 94.8% of nonsmokers reported no exposure in their home and 85.8% reported no exposure in an indoor public place.

Despite substantial success, this report shows that progress has not been the same for everyone. SHS exposure was higher among adults of low socioeconomic status, racial/ethnic minorities, young adults, and renters. SHS exposure occurred most frequently in an indoor public place, followed

by the home, and then by smoke drift in MUH. While exposure from all sources declined from 2011–2015, declines were small and may indicate slowing progress as the remaining burden of SHS exposure becomes more concentrated among vulnerable populations. Of all exposure sources, smoke drift exposure showed the least change, highlighting the need for smoke-free policies (similar to PHAs) in the affordable MUH environment.

SHS exposure among nonsmokers underscores the disproportionate impact tobacco has on low-income persons and racial/ethnic minorities, regardless of whether one smokes or not. Across exposure sources, reported exposure was notably higher among nonsmokers earning \leq \$25,000 than nonsmokers earning \geq \$75,000. While Hispanics smoke less than whites,⁸ Hispanics were four times more likely to report smoke drift exposure than whites, and about two times more likely to report indoor public place exposure. Young adults (18–24) smoke less than older adults,⁸ but 20.1% of nonsmoking young adults reported exposure in an indoor public place and 11.6% reported exposure at home. Indoor public place exposure may be partially explained by poor compliance among certain businesses, or by visits to establishments exempt from the law (i.e., casinos, smoking bars). For example, qualifying hookah lounges are allowable under the smoking bar exemption, potentially exposing nonsmoking young adults. Further research (beyond single-item measures) is needed to better understand where and why certain nonsmokers are exposed more than others.

Findings are subject to at least four limitations. BRFSS is based on self-report and vulnerable to recall bias or measurement error. Missing data may have resulted in underestimation of SHS exposure. Exposure to secondhand aerosol from electronic nicotine delivery systems was not assessed. Small sample sizes limited reliability of estimates for non-Hispanic black nonsmokers.

About 20% of nonsmoking adults in MUH reported smoke drift exposure. Exposure was higher among renters and low-income adults. HUD's recent smoke-free rule for PHAs does not extend to other affordable MUH. Smoke-free policies are legally permissible in these settings, but voluntary. Data from this report have policy and practice implications relevant to physicians, MUH staff, and tobacco control. Physicians should ask if a patient lives in MUH when evaluating risk for SHS exposure. Physicians can advise nonsmoking patients to avoid indoor areas where smoking occurs (including hookah lounges). In addition to promoting quitting, physicians can influence protective social norms by advising smokers to adopt smoke-free rules in homes. MUH companies can protect nonsmokers by replicating RI PHA's

Table 1. Secondhand Smoke Exposure among RI Nonsmoking Adults by Exposure Source, 2011-2015

Characteristic	Exposure Source		
	Home	Smoke Drift	Indoor Public Place
	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)
Combined Year Prevalence (2011-2015)	5.2%	5.1%	14.2%
Sex			
Female	4.4 (3.6 - 5.3)	5.4 (4.8 - 6.1)	12.1 (10.8 - 13.5)
Male	6.0 (4.7 - 7.4)	4.6 (3.7 - 5.5)	16.7 (14.7 - 18.6)
Age			
18-24	11.6 (7.4 - 15.7)	6.2 (4.2 - 8.2)	20.1 (14.9 - 25.5)
25-44	4.8 (3.3 - 6.2)	7.2 (5.8 - 8.5)	17.2 (14.8 - 19.7)
45-64	4.1 (3.4 - 4.7)	4.3 (3.7 - 4.9)	12.6 (11.2 - 14.0)
65+	3.6 (2.9 - 4.3)	2.8 (2.4 - 3.3)	9.2 (7.9 - 10.6)
Race/Ethnicity			
Non-Hispanic White	4.9 (4.0 - 5.7)	3.3 (2.9 - 3.7)	12.7 (11.5 - 14.0)
Non-Hispanic Black	5.6 (2.4 - 8.9)*	14.1 (7.5 - 20.8)*	19.9 (13.5 - 26.3)
Hispanic	4.8 (2.6 - 7.0)*	12.9 (10.2 - 15.5)	21.9 (17.4 - 26.3)
Other Race, Non-Hispanic	9.7 (5.2 - 14.1)*	8.1 (5.7 - 10.5)	16.1 (11.1 - 21.1)
Education			
≤High School	6.6 (5.2 - 8.1)	7.1 (5.9 - 8.2)	17.8 (15.6 - 20.1)
≥Some College	4.3 (3.4 - 5.1)	3.8 (3.3 - 4.3)	11.9 (10.7 - 13.1)
Income			
≤\$25,000	7.8 (5.8 - 9.8)	11.5 (9.8 - 13.3)	19.5 (16.6 - 22.4)
\$25,000-\$49,999	6.5 (4.4 - 8.6)	6.2 (4.7 - 7.7)	14.7 (12.2 - 17.1)
\$50,000-\$74,999	4.0 (2.7 - 5.3)	2.9 (2.1 - 3.7)	14.8 (11.8 - 17.7)
≥\$75,000	2.9 (2.1 - 3.8)	1.4 (0.9 - 1.9)	10.8 (9.1 - 12.5)
Rental Status			
Rent	7.5 (5.9 - 9.1)	16.6 (14.7 - 18.4)	--
Own	3.8 (3.1 - 4.4)	1.4 (1.1 - 1.7)	--
Children in Home			
Yes	4.6 (2.9 - 6.2)	5.0 (3.9 - 6.1)	--
No	5.5 (4.7 - 6.3)	5.1 (4.5-5.7)	--

*estimates for groups are statistically unreliable (RSEs between 20-30%) and must be interpreted with caution. Data Source: 2011-2015 RI BRFSS

voluntarily adoption of smoke-free policies. RITCP's pro-equity approach to eliminate SHS exposure includes smoke-free policy technical assistance (TA) for PHAs and other affordable MUHs. RITCP launched "*Live Smoke Free*" in 2011 in response to smoke drift complaints from PHA and other MUH residents, and currently provides no-cost workshops and individual TA. Finally, RI tobacco control interventions can simultaneously reduce socioeconomic disparities in smoking and SHS exposure by extending smoke-free policies to affordable MUHs and strategically promoting cessation services to low-income residents through on-site services, referrals to the Quitline, and health systems changes that remove barriers to cessation coverage by public and private insurers.

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