



## State-specific estimates of complete smoke-free home rules among postpartum women, 2010



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### ABSTRACT

**Background:** Secondhand smoke exposure increases an infant's risk of morbidity and mortality. We provide state-specific estimates for and characterize postpartum women with complete smoke-free home rules.

**Methods:** Data were analyzed from 26 states and New York City ( $n = 37,698$ ) from the 2010 Pregnancy Risk Assessment Monitoring System, a population-based survey of women who recently delivered live-born infants. We calculated state-specific estimates of complete rules and assessed associations between complete rules and selected characteristics.

**Results:** Overall, 93.6% (95% CI: 93.1–94.1) of women with recent live births had complete smoke-free home rules (86.8% [West Virginia] to 98.6% [Utah]). Demographic groups with the lowest percentage of rules were women who smoked during pregnancy/postpartum (77.6%), were non-Hispanic Black (86.8%), never initiated breastfeeding (86.8%), <20 years of age (87.1%), <\$15,000 annual income (87.6%), <12 years of education (88.6%), unmarried (88.6%), initiated prenatal care late/had no prenatal care (88.8%), had Medicaid coverage (89.7%), had an unintended pregnancy (90.3%), and enrolled in WIC (90.6%).

**Conclusions:** Prevalence of complete smoke-free home rules was high among women with recent live births; however, disparities exist by state and among certain sub-populations. Women, particularly smokers, should be educated during and after pregnancy about secondhand smoke and encouraged to maintain 100% smoke-free homes.

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### Introduction

Secondhand smoke (SHS) contains many toxic chemicals that can be detrimental to an infant's health (Centers for Disease Control and Prevention, 2006). Infants who are exposed to SHS are at increased risk of respiratory tract and ear infections and Sudden Infant Death Syndrome (Centers for Disease Control and Prevention, 2006). In 2010, nearly 16% of women smoked after delivery, ranging from 7.2% (Utah) to 37.5% (West Virginia) (Tong et al., 2013). Because infants spend a substantial amount of time at home, complete smoke-free home rules (i.e., no smoking by anyone anywhere in the home at any time) should be encouraged (American Academy of Pediatrics, 2009).

Beginning in 2009, the Pregnancy Risk Assessment Monitoring System (PRAMS), a state-based surveillance system of maternal behaviors and attitudes administered 2–6 months after delivery, asked whether women had a complete smoke-free home rule at the time of survey administration in all participating states (Centers for Disease Control and Prevention, 2012). Only a small number of states asked this question prior to 2009, and a previous study of smoke-free home rules in only

5 states during 2004–2008 has been published (Gibbs et al., 2012). However, state-specific estimates of the percentage of women who have complete smoke-free home rules have not been previously reported from all PRAMS states and with more recent data.

The study objectives were to calculate state-specific prevalence estimates of complete smoke-free home rules among postpartum women in 26 PRAMS states and New York City in 2010, the most recent data available, and describe women who had complete smoke-free home rules by selected characteristics. These data can be used to inform state efforts to encourage 100% smoke-free home rules among postpartum women.

### Methods

PRAMS is an ongoing state- and population-based surveillance system among women who delivered live-born infants in the United States. Details concerning the PRAMS methodology have been described elsewhere (Shulman et al., 2006). Briefly, at each site, a monthly stratified sample of 100–300 new mothers is selected systematically from birth certificates. Data are weighted to represent all women with live births in each site. Sites were included for analysis if the overall weighted response rate for a given site was  $\geq 65\%$  in 2010: Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas,

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Utah, Vermont, Washington, West Virginia, Wyoming and New York City (NYC). The Centers for Disease Control and Prevention Institutional Review Board approved the PRAMS protocol; all sites approved the study plan.

Women's report of having complete smoke-free home rules after delivery was determined from: "Which of the following statements best describes the rules about smoking inside your home now?" Respondents were categorized as having complete rules ("no one was allowed to smoke anywhere inside my home") or partial/no rules ("smoking was allowed in some rooms or at some times" or "smoking was permitted anywhere inside my home").

Prevalence and 95% confidence intervals (CIs) were estimated for each site. Data were aggregated to assess differences in prevalence by selected characteristics using Chi-square tests at  $P \leq 0.05$ . We calculated adjusted prevalence ratios (APRs) and 95% CIs using multivariable logistic regression as described by Bieler et al. (2010). The analyses were conducted in 2013 using SAS version 9.3 and SUDAAN version 11 to account for the complex survey design of PRAMS (SAS, version 9.3, 2012; SUDAAN, version 11.0, 2012).

Of 38,255 women with available data, records were excluded if data on smoke-free home rules were missing ( $n = 557$  [1.5%]). The final sample included 37,698 women. For other variables, the percentage of respondents who lacked data ranged from 0.02% (age) to 7.6% (income). Among PRAMS respondents, the average infant age was 117 days (range: 103 [Vermont]–170 [Georgia]). The data were weighted to account for sampling, nonresponse, and noncoverage and represent 52% of U.S. live births.

## Results

Based on aggregated data from 26 states and NYC, most women were aged 25–34 years (54.0%), non-Hispanic white (56.8%) and had more than 12 years of education (56.3%). The data were weighted to represent 1,916,846 women who delivered live births in the study states (Table 1). The total percentage of women who reported complete smoke-free home rules was 93.6% (95% CI: 93.1–94.1), and partial or no

**Table 1**  
Prevalence of complete smoke-free home rules after delivery among postpartum women by site, 26 states and New York City, 2010.<sup>a</sup>

	Weighted n	Complete smoke-free home rule % (95% CI)
Total sites <sup>b</sup>	1,916,846	93.6 (93.1–94.1)
Alaska	10,999	97.6 (96.0–98.6)
Arkansas	35,760	91.4 (89.3–93.1)
Colorado	64,334	96.7 (95.3–97.7)
Delaware	10,477	92.3 (90.5–93.7)
Georgia	128,963	95.6 (93.0–97.2)
Hawaii	18,461	96.6 (95.2–97.5)
Maine	12,360	95.6 (93.8–96.8)
Maryland	65,272	91.7 (89.0–93.9)
Massachusetts	68,963	95.2 (93.4–96.5)
Michigan	110,214	90.5 (88.6–92.1)
Minnesota	64,522	96.7 (95.6–97.6)
Missouri	71,974	88.6 (86.5–90.5)
Nebraska	25,065	96.0 (94.7–96.9)
New Jersey	96,038	96.1 (95.0–97.0)
New York <sup>c</sup>	110,752	95.3 (93.3–96.7)
New York City	109,761	94.9 (93.1–96.2)
Ohio	132,958	88.4 (85.8–90.5)
Oklahoma	50,484	91.3 (88.7–93.3)
Oregon	43,221	98.5 (97.3–99.1)
Pennsylvania	135,988	90.8 (88.4–92.8)
Rhode Island	10,529	93.2 (91.2–94.8)
Texas	374,798	93.3 (91.7–94.6)
Utah	50,483	98.6 (97.9–99.1)
Vermont	5926	95.0 (93.4–96.2)
Washington	83,575	97.9 (96.7–98.7)
West Virginia	17,690	86.8 (84.5–88.9)
Wyoming	7276	96.9 (95.4–97.9)

Abbreviations: CI, Confidence interval.

<sup>a</sup> Data obtained from the Pregnancy Risk Assessment Monitoring System (PRAMS). Complete smoke-free homes rules = having a rule where no one was allowed to smoke anywhere inside their home at the time of the PRAMS survey.

<sup>b</sup> Overall prevalence based on data aggregated for 26 PRAMS states and New York City.

<sup>c</sup> New York City births reported separately.

rules was 6.4% (95% CI: 5.9–6.9) (Table 1). Thus, an estimated 122,379 infants were in homes with partial or no smoke-free home rule. State-specific estimates of reporting complete rules ranged from 86.8% (West Virginia) to 98.6% (Utah).

Subgroups with the lowest prevalence of having complete smoke-free home rules after delivery were women who smoked during pregnancy and postpartum (77.6%), had never initiated breastfeeding (86.8%), were non-Hispanic Black (86.8%), were <20 years of age (87.1%), had <\$15,000 annual income (87.6%), had <12 years of education (88.6%), were unmarried (88.6%), initiated prenatal care in the third trimester or had no prenatal care (88.8%), had Medicaid coverage during pregnancy or at delivery (89.7%), had an unintended pregnancy (90.3%), or were enrolled in WIC during pregnancy (90.6%) (Table 2). No significant differences in prevalence of complete rules were observed by parity or infant age.

After adjustment, the strongest association was found for women who smoked during and after pregnancy (APR, 0.90 [95% CI: 0.88–0.92]), and they were less likely to have a complete rule compared to nonsmokers. Groups more likely to have complete rules were  $\geq 35$  years, of Hispanic ethnicity, had >12 years of education, were married, were normal weight, and breastfed their infants  $\geq 10$  weeks, though these associations were weak.

## Discussion

Overall, the majority of postpartum women (93.6%) reported having complete smoke-free home rules after delivery, higher than the national estimate for all households (81.1%) (King et al., 2013). These data suggest that women with infants may have heightened awareness of the need for 100% smoke-free environments. However, we found disparities by state and among certain sub-groups.

State-specific differences may be a result of variation in state efforts to promote smoke-free environments, such as through media and educational campaigns. As of 2013, 26 states and the District of Columbia (Centers for Disease Control and Prevention, 2013) and 593 U.S. municipalities (American for Nonsmokers' Rights Foundations, 2013) have implemented comprehensive laws that completely eliminate smoking in private workplaces, restaurants, and bars. Studies have suggested that residents of jurisdictions with comprehensive smoke-free laws are more likely to adopt household rules making homes and vehicles smoke-free, perhaps, because of greater awareness of the health risks of SHS and changes in social norms regarding the acceptability of smoking around nonsmokers (Cheng et al., 2011, 2013). Consistent with these findings, our study states with the highest prevalence estimates of complete smoke-free home rules also had comprehensive state smoke-free laws. Despite the high prevalence of complete rules in our population, in multi-unit housing, SHS can infiltrate other units, and children living in multi-unit housing are vulnerable to SHS exposure, even if no one in their household smokes (Wilson et al., 2011). Thus, educational initiatives encouraging adoption of smoke-free home rules and smoke-free policies in all homes including multi-unit housing are needed.

In our study, we found that smoking during and after pregnancy was the strongest predictor of not having complete smoke-free home rules even after adjusting for other maternal characteristics. These findings are consistent with a previous analysis of the 2004–2008 PRAMS data from 5 states (Gibbs et al., 2012). Having smoke-free home rules has been shown to reduce SHS exposure and increase smoking cessation (Centers for Disease Control and Prevention, 2006; Messer et al., 2008) even among low-income populations (Vijayaraghavan et al., 2013). Thus, clinicians or other providers who see women during and after pregnancy can educate parents, particularly smokers, about the adverse health effects of SHS for infants and encourage them to stay quit and make their homes 100% smoke-free.

The strengths of this study is that it is the largest study of smoke free home rules among postpartum women to-date, and the results are

representative of 26 states and NYC, which constitute approximately half of all U.S. live births. This study has at least two limitations. First, having a home rule was self-reported, and prevalence could have been

overestimated. However, parental report of having smoke-free home rules has been found to correlate with SHS exposure biomarkers in children (Hovell et al., 2000; Spencer et al., 2005). Also, these results

**Table 2**  
Prevalence and adjusted prevalence ratio of having complete smoke-free home rules after delivery among postpartum women by selected maternal characteristics, 26 states and New York City, 2010.<sup>a</sup>

Maternal characteristics	Unweighted n	Complete smoke-free home rules	Partial or no smoke-free home rules	Complete smoke-free home rules
		(Unweighted n = 35,399)	(Unweighted n = 2299)	Adjusted PR <sup>b</sup> (95% CI)
		% (95% CI)	% (95% CI)	
Total	37,698	93.6 (93.1–94.1)	6.4 (5.9–6.9)	
Maternal age group (yrs) <sup>*</sup>				
<20	3222	87.1 (84.8–89.2)	12.9 (10.8–15.2)	Ref
20–24	8646	89.4 (88.0–90.6)	10.6 (9.4–12.0)	1.01 (0.98–1.05)
25–34	19,896	95.5 (95.0–96.0)	4.5 (4.0–5.0)	1.04 (1.00–1.09)
≥35	5933	97.1 (96.2–97.8)	2.9 (2.2–3.8)	1.06 (1.02–1.12)
Maternal race/ethnicity <sup>*</sup>				
White, non-Hispanic	20,232	94.1 (93.4–94.6)	5.9 (5.4–6.6)	Ref
Black, non-Hispanic	5567	86.8 (85.2–88.2)	13.2 (11.8–14.8)	0.97 (0.94–1.00)
Hispanic	5989	96.3 (95.1–97.1)	3.7 (2.9–4.9)	1.05 (1.02–1.08)
American Indian/Alaska Native	1195	88.7 (82.1–93.1)	11.3 (6.9–17.9)	0.89 (0.79–1.00)
Asian/Pacific Islander	3175	96.1 (94.2–97.3)	3.9 (2.7–5.8)	0.97 (0.89–1.07)
Other	1182	94.2 (91.3–96.2)	5.8 (3.8–8.7)	1.01 (0.95–1.07)
Maternal education (yrs) <sup>*</sup>				
<12	6076	88.6 (87.1–90.1)	11.4 (9.9–12.9)	Ref
12	9865	91.0 (89.9–92.0)	9.0 (8.0–10.1)	1.01 (0.99–1.04)
>12	21,322	96.4 (95.9–96.8)	3.6 (3.2–4.1)	1.04 (1.01–1.07)
Marital status <sup>*</sup>				
Not married	14,773	88.6 (87.6–89.5)	11.4 (10.5–12.4)	Ref
Married	22,904	96.9 (96.4–97.3)	3.1 (2.7–3.6)	1.03 (1.00–1.05)
Annual income <sup>*</sup>				
<\$15,000	10,985	87.6 (86.4–88.8)	12.4 (11.2–13.6)	Ref
≥\$15,000	24,337	96.1 (95.6–96.5)	3.9 (3.5–4.4)	1.02 (1.00–1.05)
Pre-pregnancy BMI <sup>*</sup>				
Underweight (<18.5)	1766	90.5 (87.7–92.8)	9.5 (7.2–12.3)	1.01 (0.97–1.06)
Normal (18.5–24.9)	17,847	94.7 (94.0–95.3)	5.3 (4.7–6.0)	1.03 (1.01–1.06)
Overweight (25–29.9)	8500	93.6 (92.5–94.5)	6.4 (5.5–7.5)	1.02 (0.99–1.05)
Obese (≥30)	7604	91.2 (89.9–92.4)	8.8 (7.6–10.1)	Ref
Pregnancy intention <sup>*</sup>				
Intended	21,906	95.9 (95.4–96.4)	4.1 (3.6–4.6)	
Unintended	15,120	90.3 (89.3–91.1)	9.7 (8.9–10.7)	Ref
Parity				
First birth	16,311	93.5 (92.7–94.2)	6.5 (5.8–7.3)	Ref
Second or later birth	20,917	93.7 (93.0–94.3)	6.3 (5.7–7.0)	0.99 (0.97–1.01)
Initiation of PNC <sup>*</sup>				
1st Trimester	28,685	94.9 (94.4–95.3)	5.1 (4.7–5.6)	1.03 (0.98–1.09)
2nd Trimester	4806	88.9 (87.0–90.5)	11.1 (9.5–13.0)	1.00 (0.94–1.06)
3rd Trimester or No PNC	1341	88.8 (85.3–91.6)	11.2 (8.4–14.7)	Ref
Health insurance coverage during pregnancy or at delivery <sup>*</sup>				
Private	19,412	96.8 (96.3–97.2)	3.2 (2.8–3.7)	1.06 (0.95–1.18)
Medicaid	16,152	89.7 (88.7–90.5)	10.3 (9.5–11.3)	1.04 (0.93–1.15)
Other Insurance <sup>c</sup>	1057	95.4 (92.0–97.4)	4.6 (2.6–8.0)	1.06 (0.93–1.21)
Uninsured	574	91.0 (84.5–94.9)	9.0 (5.1–15.5)	Ref
WIC enrollment during pregnancy <sup>*</sup>				
Yes	18,397	90.6 (89.8–91.4)	9.4 (8.6–10.2)	Ref
No	19,111	96.4 (95.9–96.9)	3.6 (3.1–4.1)	1.02 (0.99–1.04)
Breastfeeding duration <sup>*</sup>				
Never initiated	6161	86.8 (85.1–88.2)	13.2 (11.8–14.9)	Ref
Initiated and <10 weeks	11,233	92.1 (91.1–93.0)	7.9 (7.0–8.9)	1.01 (0.99–1.02)
Initiated and ≥10 weeks	18,935	97.3 (96.9–97.7)	2.7 (2.3–3.1)	1.03 (1.02–1.05)
Postpartum smoking status <sup>*</sup>				
Nonsmoker during pregnancy and postpartum	27,503	96.2 (95.7–96.6)	3.8 (3.4–4.3)	Ref
Quit and remained quit postpartum	2635	94.7 (93.0–96.0)	5.3 (4.0–7.0)	1.00 (0.98–1.01)
Quit and relapsed postpartum	2056	86.9 (83.6–89.6)	13.1 (10.4–16.4)	0.96 (0.93–0.98)
Smoker during pregnancy and postpartum	4703	77.6 (75.2–79.8)	22.4 (20.2–24.8)	0.90 (0.88–0.92)
Infant age (mo)				
<3	6768	93.6 (92.4–94.6)	6.4 (5.4–7.6)	0.99 (0.98–1.01)
3–5	23,861	93.8 (93.2–94.3)	6.2 (5.7–6.8)	1.00 (0.98–1.01)
>5	5429	93.4 (92.1–94.6)	6.6 (5.4–7.9)	Ref

Abbreviations: BMI, body mass index; CI, confidence intervals; mo, month; PNC, prenatal care; PR, prevalence ratio; Ref, reference; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; yrs, years.

<sup>\*</sup>  $P < 0.05$  based on Chi-square test.

<sup>a</sup> Complete smoke-free homes rules = having a rule where no one was allowed to smoke anywhere inside their home at the time of the PRAMS survey. Data aggregated for 26 PRAMS states (Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Washington, West Virginia, and Wyoming) and New York City with data available for 2010.

<sup>b</sup> Adjusted prevalence ratio of having a complete smoke-free home rule.

<sup>c</sup> Other health insurance coverage includes Tricare, other military health insurance, Indian Health Service, or state-specific SCHIP or CHIP insurance program.

may not be generalizable beyond the PRAMS sites included in this analysis.

Of the 1.9 million births that our study population represents, an estimated 120,000 infants are in homes with partial or no smoke-free home rules; half of those infants' mothers smoked after delivery, exposing their infants to SHS. Efforts are needed to educate women during and after pregnancy and their families of the importance of adopting 100% smoke-free rules in homes and other private settings to protect infants' health and well-being.

#### Conflict of interest statement

The authors declare that there are no conflicts of interests.

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