

Original Investigation

# “How Is Smoking Handled in Your Home?": Agreement Between Parental Reports on Home Smoking Bans in the United States, 1995–2007

Xiao Zhang, M.S.,<sup>1</sup> Ana P. Martinez-Donate, Ph.D.,<sup>1,2</sup> Daphne Kuo, Ph.D.,<sup>3</sup> & Nathan R. Jones, Ph.D.<sup>2</sup>

<sup>1</sup> Department of Population Health Sciences, University of Wisconsin–Madison, Madison, WI

<sup>2</sup> Carbone Cancer Center, University of Wisconsin–Madison, Madison, WI

<sup>3</sup> Population Health Institute, University of Wisconsin–Madison, Madison, WI

Corresponding Author: Ana P. Martinez-Donate, Ph.D., Department of Population Health Sciences, University of Wisconsin–Madison, 610 Walnut Street, 605 WARF, Madison, WI 53726-2397, USA. Telephone: 608-261-1380; E-mail: martinezdona@wisc.edu

Received November 2, 2011; accepted January 9, 2012

## Abstract

**Introduction:** Home smoking bans significantly reduce secondhand smoke exposure among children, but parents may offer discordant reports on whether there is a home smoking ban. The purpose of this study was to examine national trends in (a) parental discordance/concordance in the reporting of home smoking bans and (b) correlates of discordant/concordant reports among two-parent households with underage children from 1995 to 2007.

**Methods:** Data from the 1995/1996, 1998/1999, 2001/2002, 2003, and 2006/2007 Tobacco Use Supplement of the U.S. Current Population Survey were used to estimate prevalence rates and multinomial logistic regression models of discordant/concordant parental smoking ban reports by survey period.

**Results:** Overall, the percentage of households in which the 2 parents gave discordant reports on a complete home smoking ban decreased significantly from 12.7% to 2.8% from 1995 to 2007 ( $p < .001$ ). Compared with households where both parents reported a complete smoking ban, discordant reports were more likely to be obtained from households with current smokers ( $p < .01$ ) across survey periods. Compared with households where both parents reported the lack of a complete home smoking ban, discordant reports were more likely among households with college graduates, no current smokers, and parents with Hispanic ethnicity ( $p < .05$ ).

**Conclusions:** Parental concordance on the existence of a home smoking ban increased from 1995 to 2007. This suggests estimates of home smoking bans based on just one parent may be more reliable now than they were in the past. Interventions to improve the adoption and enforcement of home smoking bans should target households with current smoker parents.

doi:10.1093/ntr/nts005

Advance Access Published on February 29, 2012

© The Author 2012. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com

## Introduction

Secondhand smoke (SHS) exposure increases the risk of premature death and illness in adults and children. Children are particularly vulnerable to the effects of SHS, and as a result of exposure, they can experience increased risk for sudden infant death syndrome, acute respiratory infections, ear problems, and more severe asthma (U.S. Department of Health and Human Services [USDHHS], 2007). SHS may also contribute to increased blood lead level in children (Apostolou et al., 2011). Recently, attention has been drawn to a new mode of involuntary exposure to tobacco constituents—thirdhand smoke (THS), which refers to residual tobacco smoke contamination that remains after the cigarettes are extinguished (Winickoff et al., 2009). Children are especially susceptible to THS exposure because they breathe near, crawl and play on, touch, and mouth-contaminated surfaces. Because the home is a primary location of SHS and THS exposure for children (Gonzales, Malcoe, Kegler, & Espinoza, 2006; Mantziou, Vardavas, Kletsios, & Priftis, 2009; USDHHS, 2007), the adoption of a home smoking ban can significantly reduce the level of SHS and THS exposure.

A home smoking ban is a self-established behavioral household prescription against involuntary exposure. It is defined as rules set up by household residents or other individuals to restrict or ban cigarette smoking inside the home (Martinez-Donate, Johnson-Kozlow, Hovell, & González-Pérez, 2009). Previous research has found home smoking bans were effective in reducing cotinine levels, an indicator of exposure to smoke, among children (Spencer, Blackburn, Bonas, Coe, & Dolan, 2005). Studies also suggest that household smoking rules convey an anti-tobacco social norm that helps deter adolescents from smoking regardless of their parents' or friends' smoking behavior (Albers, Biener, Siegel, Cheng, & Rigotti, 2008; Clark et al., 2006; Klein, Forster, Erickson, Lytle, & Schillo, 2009; Rodriguez, Tscherne, & Audrain-McGovern, 2007).

## Methods

### Study Population

The 1995–1996, 1998–1999, 2001–2002, 2003, and 2006–2007 TUS-CPS data were used in the current study. As a supplement to the CPS, all household members aged 15 years or older permanently residing in the households selected through stratified random sampling are eligible for the interview. The TUS-CPS provides data on a nationally representative sample of about 240,000 civilian noninstitutionalized individuals within a given survey period. For the five yearly survey periods, the TUS-CPS response rate, including both self- and proxy responses, were 84.5%, 83.5%, 75.0%, 75.2%, and 73.7%, respectively.

In the current study, the analytical unit was the primary family household because the analysis focused on home smoking rules. Only two-parent households with underage children (<18 years old) were selected. A parent refers to a household's reference person or his/her spouse or partner, and they did not need to be the underage child/children's biological parent. The no-smoking home bans were reported by one or both parents in two-parent households. Households without valid reports on home smoking bans from either of the parents were excluded from analyses. The TUS-CPS did not collect proxy responses on home smoking ban status.

### Measures

#### Home Smoking Bans

All respondents were asked a question concerning the rules about smoking in their home. Based on evidence demonstrating the limited effectiveness of partial smoking bans in the household (Blackburn et al., 2003; Wakefield et al., 2000), respondents' answers were classified into two categories: a complete smoking ban (i.e., "No one is allowed to smoke anywhere INSIDE YOUR HOME") versus a partial or no-smoking ban (i.e., "Smoking is allowed in some places or at some times INSIDE YOUR HOME" or "Smoking is permitted anywhere INSIDE YOUR HOME").

There were minor changes in the wording of the home smoking ban question after 2002. The 2003 and 2006 version of the question replaced "in your home" with "inside your home." In addition, the version after 2002 also added an explanation of the meaning of word "rule" (i.e., rules include any unwritten rules and pertain to all people whether or not they reside in the home or are visitors, workmen, etc.).

Based on responses from the two parents/caregivers to the home smoking ban question, households were classified into three categories: households in which spouses/partners provided discordant responses on the existence of a complete home smoking ban; households in which both spouses/partners concordantly reported a complete home smoking ban; and households where neither of the spouses/partners reported a complete home smoking ban.

#### Household Characteristics

The following factors potentially associated with the establishment of a nonsmoking rule in the home were analyzed: household structure, highest parental education level, age of the youngest child, annual household income, parental race/ethnicity,

In the United States, survey results consistently showed that the prevalence of home smoking bans has increased over time (Levy, Romano, & Mumford, 2004; Trosclair et al., 2007; Zhang, Martinez-Donate, Kuo, Jones, & Palmersheim, 2012). By 2008, most U.S. adults reported a smoke-free home, and the percentage of smoke-free homes ranged from 68.8% to 85.7% depending on the state (Malarcher, Shah, Tynan, Maurice, & Rock, 2009). Home smoking bans have been found to be associated with a number of individual and household characteristics, including ethnicity, presence and age of children, smoking status of household residents, family members' educational attainment, household income, and smoking status of friends (Binns, O'Neil, Benuck, & Ariza, 2009; Gilpin, White, Farkas, & Pierce, 1999; Johansson & Halling, 2003; King, Hyland, Borland, McNeill, & Cummings, 2011; Martinez-Donate et al., 2007; Zhang et al., 2011).

However, analyses of home smoking bans have relied largely on the sole response of one household member regarding the existence and degree of smoking bans in the home. In contrast, relatively few studies have investigated potential discordance in perceptions of home smoking bans among different household members. Mumford et al. used 1998/1999 Tobacco Use Supplement (TUS) to the U.S. Current Population Survey (CPS) and found that an estimated 12% of their sample of households with two or more adults provided discordant reports about home smoking bans (Mumford, Levy, & Romano, 2004). The discordance varied by smoking status, socioeconomic status, race/ethnicity, and presences of children. Discordant reports of bans may be the result of differential reporting due to different duration and frequency of observation by reporters, different operational definition, and social desirability. Ding et al. found that children in families that provided discordant reports on home smoking bans were exposed to higher SHS level compared with those with complete bans (Ding et al., 2011). This suggests that concordant ban reports are associated with reduced SHS exposure, and discordant reports could reflect lax enforcement of or incomplete smoking bans. In a qualitative study of household smoking restrictions, some participants reported resistance from smokers in the family when someone proposed to ban smoking in the home. Some of these families compromised and set up a partial ban (Kegler, Escoffery, Groff, Butler, & Foreman, 2007), which reduced but did not completely eliminate SHS exposure (Blackburn et al., 2003; Wakefield et al., 2000).

As overall rates of home smoking bans have increased and social recognition of the harm of involuntary smoking exposure, especially to children, has greatly improved over the last decade throughout the United States (Hyland et al., 2009), the demographic and socioeconomic factors associated with the discordance may have changed accordingly. To date, we are unaware of any study examining this question. Yet, it has important implications for both research methodology and public health practice.

The current study used nationally representative surveys to track the evolution of parental discordance/concordance in the reporting of home smoking bans among two-parent households with underage children from 1995 to 2007. We also investigated household and parental characteristics associated with discordant/concordant home ban reports over this period.

## How is smoking handled in your home?

parental age, and parental smoking status. The specific categories considered are shown in Table 1. Smoking status was assessed for each parent residing in the households. Based on parental smoking status, households were categorized into four groups: households where both parents are current smokers (smoked more than 100 cigarettes in their lifetime and currently smoke some days or every day), households with only one current smoker, households with no current smokers but where one or both parents were former smokers (smoked more than 100 cigarettes in their lifetime, but do not currently smoke), and households with neither current nor former smokers.

### Statistical Analysis

Descriptive statistics on the prevalence of discordant/concordant reports were calculated over different survey periods. Multinomial

logistic regressions were estimated to explore (a) associations between sociodemographic characteristics and household-level variables and concordant/discordant smoking ban reports among two-parent households and (b) significant changes in prevalence of concordant/discordant reports from one survey period to the next. Two comparisons (both spouses reported a complete home smoking ban vs. discordant reports, and neither spouses reported a home ban vs. discordant reports) were examined using these models.

For multinomial logistic regressions, odds ratio (OR) values and their 95% CI were compared across survey periods to investigate whether there were significant changes in the relationships between each factor and home smoking ban status. Nonoverlapping 95% CI were considered significant at the 95% level. Survey and household weights provided by the TUS-CPS

**Table 1. Sociodemographic Characteristics of Two-Parent Households with Underage Children in the United States (1995–2007)**

Sociodemographic characteristics	1995–1996 (N <sup>a</sup> = 34,024)	1998–1999 (N = 31,670)	2001–2002 (N = 31,629)	2003 (N = 31,146)	2006–2007 (N = 28,685)
Highest education level					
Less than high school	7.1	6.7	6.4	7.1	7.1
High school graduate	56.4	53.4	51.8	49.1	47.3
College graduate	36.6	39.9	41.8	43.8	45.6
Age of youngest child, years					
Less than 1	10.3	10.1	9.6	9.6	9.9
1–5	38.5	37.7	37.5	38.3	37.7
6–12	33.2	33.6	33.9	33.4	32.1
13 or older	18.0	18.7	19.0	18.7	20.2
Annual household income					
Less than 25,000	21.9	16.7	13.2	13.4	10.7
25,000–49,999	36.9	31.5	27.4	26.1	23.2
50,000 or greater	41.3	51.8	59.4	60.5	66.1
Parental race/ethnicity					
Both NH White <sup>b</sup>	74.2	71.6	70.0	66.9	65.1
Both NH Black	7.3	7.3	7.4	6.9	6.6
Both Hispanic	9.1	10.8	11.4	13.4	14.0
Both other	3.4	4.0	4.1	4.9	5.2
NH White/NH Black	0.6	0.6	0.8	0.6	0.8
NH White/Hispanic	3.2	3.4	3.9	3.9	4.4
NH White/other	1.8	1.9	1.9	2.7	2.8
Other combinations	0.5	0.5	0.7	0.8	1.0
Parental smoking status					
Only never-smoker	38.7	42.4	45.8	51.0	53.1
No current, but one or two former smoker(s)	27.3	26.7	25.4	23.8	23.4
One current smoker	22.8	21.6	20.1	18.3	16.6
Two current smokers	11.3	9.3	8.7	6.8	6.9
Parental age					
Both 18–29	10.5	10.1	9.3	9.1	9.1
Both 30–39	31.9	29.3	28.2	27.8	26.4
Both 40–49	21.5	22.7	24.0	24.1	23.7
Both 50 or older	5.0	5.9	6.5	7.1	8.6
18–29/30–39	8.9	8.5	8.4	8.1	7.8
30–39/40–49	14.8	15.0	14.4	14.2	14.0
40–49/50 or older	5.7	6.6	7.5	7.8	8.6
Other combinations	1.8	1.8	1.9	1.8	1.8

Note. NH = Non-Hispanic.

<sup>a</sup>N represents the number of two-parent households in our sample for each survey period.

were used to account for the complex sampling design and clustering to produce population estimates. All analyses were performed with the software STATA/SE 11.1 (StataCorp LP, College Station, TX).

## Missing Data

Across the five survey periods, about 20% of individuals did not answer the home smoking ban question, and as a result, around 40% of the households only had one parental response. Exclusion of such households would have resulted in a substantial sample reduction and potential bias of our estimates. In our analysis, the multiple imputation (MI) approach was utilized. MI is an analytic technique that uses all the information available in the study to replace missing values with a set of predicted values in order to take into account the model uncertainty (Allison, 2000; Rubin, 1987). Subsequently, each completed data set is analyzed using standard complete-data procedures, and effects are pooled to create one estimate of parameters.

MI estimation is used to deal with the missing responses to the home ban question by regressing home smoking ban reports on known information: gender, the response from the other parent, household highest education level, age of the youngest child, annual household income, household race/ethnicity composition, parental age, and parental smoking status. The estimated responses were then matched with the other parent's response. Multinomial logistic regressions of home smoking ban status on individual characteristics, including age, race, education, and smoking status, were estimated for data before and after imputation. The adjusted odds ratio (AOR) for each variable did not differ from each other significantly at the 5% level. Both the descriptive and multivariate results reported in this article used the MI dataset.

## Results

### Trends in Household Discordance/Concordance of Parental Reports

Tables 2 and 3 show the prevalence of discordant/concordant reports and their associations with sociodemographic factors. The overall percentage of households in which the two parents gave discordant reports on a complete home smoking ban decreased significantly from 12.7% during 1995–1996 to 2.8% during 2006–2007 ( $p < .001$ ). In addition, the prevalence of households that lacked a complete home smoking ban according to both parents decreased significantly from 35.2% to 12.1% ( $p < .001$ ). Accordingly, the percentage of households in which both parents agreed on the existence of a complete home smoking ban increased from 52.1% to 85.1% ( $p < .001$ ).

The prevalence of home smoking ban stratified by parental smoking status indicates that the trends were similar among the four groups. However, throughout all the survey periods, households with only never-smokers had the highest percentage of concordant reports on complete bans, followed by those with no current but at least one former smoker, and followed by households with one current smoker. Households with two current smokers had the lowest prevalence of concordant reports on a complete home smoking ban.

### Comparison of Concordant Complete Bans Versus Discordant Reports

Several sociodemographic and household-level characteristics were predictive of parental reports on home smoking ban and the associations changed over time (Table 2). During the first study period (i.e., 1995–1996), the comparison of concordant complete home smoking ban reports versus discordant reports revealed that the odds of providing concordant reports were significantly higher among households that included parents with a college degree and of Hispanic ethnicity ( $p < .05$ ). On the other hand, discordant reports were significantly more likely to be obtained as the age of the youngest child increased and with the presence of former or current smokers ( $p < .01$ ). However, these associations, with the exception of the effects of parental smoking, were less consistent throughout subsequent years. In the survey period of 2003, age of youngest child remained a significant predictor of discordant reports but annual household income became a significant predictor—the AOR value for households with an annual income of at least \$50,000 versus households reporting an annual income of less than \$25,000 was 1.50 ( $p < .05$ ). In year 2006–2007, discordant reporting remained significantly associated with annual income and parental smoking, but the presence of former smokers was not associated with odds of discordant parental responses.

### Comparison of Concordant No-complete Bans Versus Discordant Reports

The likelihood of concordant no-smoking ban reports versus discordant reports among two-parent households was associated with parental highest level of education (from 1995/1996 to 2006/2007), age of youngest child (from 1995/1996 to 2001/2002), annual household income (from 1995/1996 to 2001/2002), parental race/ethnicity (from 1995/1996 to 2006/2007), and parental smoking status (from 1995/1996 to 2006/2007), and parental age (from 1998/1999 to 2006/2007), but the strength of these associations changed over time (Table 3). A comparison between the figures in Tables 2 and 3 suggests that the characteristics of households in which discordant reports were provided were more similar to those with concordant reports of a complete home smoking ban than to households with concordant no-ban reports.

## Discussion

Our findings reveal that the percentage of households in which parents provided reports of concordant complete home smoking ban showed a considerable increase from 1995–1996 to 2006–2007. This outcome is particularly common among households with smoker parents. By 2006–2007, the prevalence of concordant reports of a complete home smoking ban was 2.5 times and 5 times greater than in 1995–1996, for households with one and two current smokers, respectively. We regard this increase as an important achievement in public health because it is within such households that children are most likely to be exposed to SHS and THS. However, disparities in rates of home smoking bans and discordant reports among groups identified by sociodemographic factors persisted over time and suggest the need to develop interventions to increase children's level of protection from SHS and THS in disadvantaged households.

**Table 2. Sociodemographic Factors Associated With Establishment of a Complete Smoking Home Ban: Concordant Complete Home Smoking Ban vs. Discordant Reports<sup>a</sup>**

Household characteristics	1995–1996		1998–1999		2001–2002		2003		2006–2007	
	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI
Overall	12.7	Ref	10.8	1.41 (1.31–1.51)	6.5	2.68 (2.47–2.91)	3.3	5.83 (5.32–6.37)	2.8	7.44 (6.61–8.37)
Highest education level										
Less than high school	13.2	Ref	10.4	Ref	7.3	Ref	4.2	Ref	3.4	Ref
High school graduate	12.3	1.27 (1.04–1.55)	11.0	1.04 (0.82–1.32)	7.0	1.16 (0.82–1.65)	3.8	1.11 (0.75–1.63)	3.2	1.14 (0.67–1.68)
College graduate	13.0	1.48 (1.19–1.86)	10.5	1.24 (0.98–1.58)	5.8	1.48 (1.02–2.14)	2.7	1.27 (0.81–1.99)	2.3	1.26 (0.80–1.98)
Age of youngest child, years										
Less than 1	11.9	Ref	10.7	Ref	6.6	Ref	2.7	Ref	2.4	Ref
1–5	12.8	0.79 (0.68–0.93)	10.8	0.87 (0.70–1.09)	6.7	0.90 (0.71–1.13)	3.3	0.74 (0.51–1.06)	2.4	0.98 (0.68–1.42)
6–12	12.7	0.72 (0.60–0.87)	10.8	0.82 (0.66–1.03)	6.6	0.78 (0.61–0.99)	3.7	0.59 (0.40–0.88)	3.1	0.71 (0.43–1.16)
13 or older	12.7	0.67 (0.54–0.83)	10.8	0.83 (0.65–1.04)	6.0	0.84 (0.61–1.16)	3.2	0.68 (0.45–1.02)	3.3	0.69 (0.40–1.17)
Annual household income										
Less than 25,000	12.5	Ref	10.5	Ref	7.0	Ref	4.3	Ref	4.2	Ref
25,000–49,999	12.4	1.07 (0.94–1.22)	10.5	1.10 (0.93–1.30)	6.8	1.10 (0.88–1.36)	3.8	1.20 (0.91–1.58)	3.3	1.38 (0.99–1.93)
50,000 or greater	13.1	1.12 (0.97–1.29)	11.0	1.10 (0.93–1.29)	6.3	1.13 (0.92–1.39)	2.9	1.50 (1.12–2.00)	2.4	1.96 (1.41–2.73)
Parental race/ethnicity										
Both NH White	12.6	Ref	10.6	Ref	6.6	Ref	3.3	Ref	2.8	Ref
Both NH Black	12.6	1.00 (0.79–1.26)	11.7	0.90 (0.70–1.15)	5.8	1.14 (0.82–1.60)	3.9	0.85 (0.58–1.25)	3.2	0.89 (0.55–1.44)
Both Hispanic	13.6	1.32 (1.11–1.57)	11.1	1.24 (1.04–1.48)	6.9	1.26 (0.97–1.62)	3.7	1.12 (0.79–1.58)	2.8	1.26 (0.89–1.79)
Both other	13.8	1.13 (0.88–1.46)	12.3	0.89 (0.68–1.15)	5.9	1.14 (0.80–1.62)	3.3	1.01 (0.67–1.53)	2.1	1.43 (0.85–2.39)
NH White/NH Black	15.4	0.92 (0.42–2.02)	9.0	1.18 (0.48–2.88)	5.6	1.26 (0.42–3.83)	1.6	2.89 (0.21–39.36)	4.3	0.63 (0.26–1.53)
NH White/Hispanic	12.1	1.32 (0.99–1.77)	9.0	1.41 (1.01–1.97)	7.1	1.10 (0.79–1.54)	3.3	1.16 (0.68–1.98)	2.3	1.36 (0.78–2.38)
NH White/other	10.0	1.45 (1.03–2.04)	12.3	0.95 (0.67–1.34)	5.1	1.40 (0.78–2.53)	2.9	1.44 (0.77–2.72)	3.4	0.87 (0.53–1.44)
Other combinations	12.5	1.17 (0.60–2.27)	9.0	1.57 (0.55–4.47)	4.8	1.52 (0.42–5.51)	3.1	1.21 (0.40–3.65)	2.0	1.29 (0.38–4.38)
Parental smoking status										
Only never-smoker	11.7	Ref	9.0	Ref	5.2	Ref	2.3	Ref	2.3	Ref
No current, but one or two former smoker(s)	15.7	0.63 (0.56–0.71)	12.4	0.64 (0.57–0.72)	6.9	0.69 (0.56–0.84)	3.5	0.59 (0.45–0.77)	2.5	0.94 (0.72–1.22)
One current smoker	12.8	0.34 (0.28–0.40)	13.0	0.30 (0.26–0.34)	8.8	0.31 (0.26–0.37)	5.3	0.27 (0.22–0.35)	4.1	0.41 (0.32–0.52)
Two current smokers	8.2	0.18 (0.14–0.22)	8.6	0.19 (0.15–0.24)	7.0	0.19 (0.14–0.27)	5.3	0.15 (0.11–0.21)	4.6	0.25 (0.17–0.36)
Parental age										
Both 18–29	12.2	Ref	10.5	Ref	7.7	Ref	4.1	Ref	2.9	Ref
Both 30–39	12.8	0.95 (0.79–1.14)	10.6	0.91 (0.74–1.12)	7.1	0.99 (0.77–1.27)	3.0	1.08 (0.77–1.51)	2.4	1.00 (0.66–1.53)
Both 40–49	13.1	1.02 (0.83–1.26)	10.8	0.92 (0.73–1.17)	5.5	1.31 (0.93–1.85)	3.4	0.95 (0.66–1.37)	2.9	0.90 (0.57–1.40)

Table 2. Continued

Table 2. Continued

Household characteristics	1995-1996		1998-1999		2001-2002		2003		2006-2007	
	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI	Discordant ban (%)	AOR and 95% CI
Both 50 or older	12.9	1.01 (0.78-1.32)	12.1	0.79 (0.59-1.04)	6.4	1.09 (0.72-1.65)	3.6	0.92 (0.58-1.43)	3.6	0.77 (0.47-1.27)
18-29/30-39	11.8	1.01 (0.82-1.26)	11.4	0.86 (0.67-1.11)	6.8	1.10 (0.78-1.54)	3.9	0.86 (0.58-1.29)	4.9	0.85 (0.55-1.30)
30-39/40-49	12.6	1.01 (0.83-1.23)	10.1	0.95 (0.76-1.19)	6.6	1.12 (0.81-1.54)	3.5	1.01 (0.69-1.48)	5.8	1.03 (0.65-1.62)
40-49/50 or older	12.2	1.17 (0.88-1.55)	11.0	0.89 (0.67-1.20)	6.6	1.06 (0.70-1.62)	2.8	1.23 (0.77-1.97)	6.2	0.87 (0.50-1.53)
Other combinations	12.2	0.93 (0.63-1.37)	11.0	0.82 (0.53-1.25)	4.8	1.42 (0.73-2.74)	2.9	1.10 (0.50-2.42)	2.8	0.73 (0.38-1.41)

Note. NH = Non-Hispanic; AOR = adjusted odds ratio.

<sup>a</sup>Discordant reports were regarded as the reference outcome.

<sup>b</sup>N represents the number of two-parent households in our sample for each survey period.

Our study found that throughout the study period, differences in sociodemographic and household factors between households, in which parents disagreed regarding their home smoking ban status and those in which both parents reported the adoption of a complete home smoking ban, attenuated or disappeared. This outcome suggests that disparities in child SHS and THS exposure in the home have decreased over the study period. However, despite these trends, it is important to note that the pattern of parental smoking is still quite different between these two types of households, and therefore, it remains inappropriate to collapse these two categories of households into one. By the end of the study period, households in which both parents were current smokers were still about five times more likely to provide discordant responses regarding the home smoking ban status compared with households with only never-smokers. The comparison of households that yielded discordant parental reports versus those that yielded concordant parental reports of not having a home smoking ban indicated that these two sets of households differed in several important ways. Households with one or two college graduates were less likely to offer a concordant no-ban report as opposed to a discordant report over the decade. Households with infants and annual income \$50,000 or greater were less likely to yield concordant parental reports on the lack of a home smoking bans for the first three survey periods than households with older children and lower income, but differences based on presence of infants and income were nonsignificant in 2003. These results suggest disparities by household composition and socioeconomic status in home smoking ban status and, possibly, SHS and THS exposure have decreased in recent years. In addition, households with two Hispanic parents were less likely than households with other race/ethnicity parental composition to concordantly report the lack of home smoking ban. This result is consistent with previous research on Hispanic populations suggesting higher prevalence of home smoking bans among this population compared with other ethnic and racial groups (Yousey, 2006).

The distributions of parental smoking status were significantly different between households with concordant reports of no home smoking bans and those of discordant reports. Households with current smokers were three to seven times more likely to concordantly report the lack of home smoking bans compared with households with only never-smokers. Thus, both comparisons of households (i.e., both reported complete home bans vs. discordant reports, neither reported a home ban vs. discordant reports) indicated that parental smoking status is a strong predictor of which discordance/concordance category a household might belong to. Households with current smokers were much more likely to not have home smoking bans or offered discordant parental reports on the existence and degree of a home smoking ban. The gap by smoking status persisted over time. This finding has important implications for future interventions. First, it indicates that underage children living in households with current or former smoker continue to be less likely to be protected by a home smoking ban. Thus, second, it underscores the need to focus on households with one or two parents who smoke to promote their adoption of home smoking bans and good communication among household members to guarantee the enforcement of home smoking bans. Finally, it suggests that one of the most direct and effective ways to reduce the risk of SHS and THS exposure in the households would be

**Table 3. Sociodemographic Factors Associated With Establishment of a Complete Smoking Home Ban: Concordant No-home Smoking Ban vs. Discordant Reports<sup>a</sup>**

Household characteristics	1995–1996 (N <sup>b</sup> = 34,024)		1998–1999 (N = 31,670)		2001–2002 (N = 31,629)		2003 (N = 31,146)		2006–2007 (N = 28,685)	
	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI
Overall	35.2	Ref	27.0	0.90 (0.83–0.98)	22.3	1.20 (1.10–1.31)	16.4	1.72 (1.55–1.90)	12.1	1.43 (1.25–1.63)
Highest education level										
Less than high school	42.3	Ref	32.7	Ref	26.6	Ref	18.8	Ref	15.2	Ref
High school graduate	43.5	0.91 (0.74–1.12)	35.2	0.81 (0.62–1.05)	30.4	0.86 (0.60–1.25)	23.2	0.88 (0.57–1.33)	17.9	0.81 (0.48–1.37)
College graduate	21.1	0.63 (0.49–0.80)	15.1	0.55 (0.42–0.72)	11.7	0.62 (0.41–0.93)	8.4	0.58 (0.35–0.95)	5.5	0.51 (0.31–0.85)
Age of youngest child, years										
Less than 1	25.5	Ref	17.8	Ref	15.1	Ref	9.3	Ref	7.2	Ref
1–5	32.7	1.20 (1.00–1.45)	23.9	1.37 (1.05–1.79)	18.9	1.23 (0.95–1.61)	14.1	1.12 (0.74–1.68)	9.3	1.19 (0.78–1.83)
6–12	38.2	1.41 (1.16–1.71)	30.4	1.61 (1.22–2.13)	25.6	1.57 (1.19–2.07)	18.6	1.15 (0.74–1.81)	14.2	1.27 (0.71–2.28)
13 or older	40.7	1.53 (1.22–1.91)	32.5	1.78 (1.34–2.37)	27.1	1.68 (1.19–2.38)	20.9	1.43 (0.92–2.23)	16.2	1.35 (0.73–2.49)
Annual household income										
Less than 25,000	43.2	Ref	36.6	Ref	32.8	Ref	25.8	Ref	20.6	Ref
25,000–49,999	39.4	0.96 (0.84–1.10)	32.2	0.85 (0.71–1.02)	27.8	0.83 (0.66–1.04)	21.2	0.88 (0.66–1.17)	17.3	1.11 (0.78–1.58)
50,000 or greater	27.6	0.83 (0.71–0.97)	20.8	0.64 (0.53–0.78)	17.6	0.67 (0.54–0.83)	12.4	0.75 (0.55–1.02)	9.3	0.92 (0.65–1.30)
Parental race/ethnicity										
Both NH White <sup>c</sup>	37.6	Ref	29.1	Ref	24.4	Ref	18.2	Ref	13.6	Ref
Both NH Black	36.4	0.96 (0.74–1.27)	28.8	0.84 (0.65–1.10)	25.5	1.25 (0.86–1.82)	18.0	0.89 (0.58–1.37)	13.6	0.99 (0.56–1.72)
Both Hispanic	22.7	0.50 (0.41–0.62)	15.7	0.45 (0.36–0.56)	11.9	0.41 (0.31–0.56)	8.4	0.40 (0.27–0.60)	6.0	0.45 (0.30–0.67)
Both other	20.0	0.57 (0.42–0.77)	19.6	0.69 (0.52–0.93)	13.0	0.71 (0.47–1.06)	10.6	0.62 (0.39–1.00)	7.4	1.00 (0.56–1.80)
NH White/NH Black	34.5	0.59 (0.25–1.40)	37.4	1.63 (0.69–3.89)	33.6	1.56 (0.49–4.98)	28.0	4.76 (0.26–54.57)	18.4	0.86 (0.31–2.36)
NH White/Hispanic	25.7	0.69 (0.51–0.93)	23.6	0.98 (0.66–1.46)	16.6	0.59 (0.40–0.86)	14.7	0.72 (0.39–1.30)	10.0	0.94 (0.50–1.77)
NH White/other	34.6	0.91 (0.62–1.34)	24.1	0.67 (0.44–1.01)	22.2	1.15 (0.58–2.26)	18.0	1.20 (0.61–2.36)	10.5	0.69 (0.39–1.23)
Other combinations	36.9	0.83 (0.41–1.69)	24.4	1.15 (0.39–3.42)	20.1	0.92 (0.23–3.67)	12.5	0.69 (0.20–2.37)	14.5	1.59 (0.43–5.95)
Parental smoking status										
Only never-smoker	14.1	Ref	8.7	Ref	7.0	Ref	5.1	Ref	3.3	Ref
No current, but one or two former smoker(s)	23.0	1.12 (0.97–1.29)	17.3	1.29 (1.10–1.51)	13.3	1.23 (0.95–1.59)	9.2	0.97 (0.71–1.32)	5.8	1.41 (1.04–1.92)
One current smoker	61.6	3.63 (3.11–4.24)	52.9	3.67 (3.17–4.24)	47.0	3.37 (2.75–4.13)	38.8	2.78 (2.16–3.57)	30.6	4.33 (3.27–5.73)
Two current smokers	83.4	7.11 (5.87–8.62)	77.8	7.27 (5.89–8.98)	72.3	6.13 (4.35–8.63)	65.1	4.34 (3.06–6.16)	54.4	6.51 (4.36–9.72)
Parental age										
Both 18–29	35.3	Ref	25.6	Ref	24.0	Ref	16.1	Ref	10.4	Ref
Both 30–39	34.0	1.06 (0.87–1.28)	24.6	1.23 (0.99–1.54)	19.5	1.12 (0.85–1.46)	13.8	1.47 (1.02–2.12)	9.8	1.56 (0.99–2.47)
Both 40–49	32.3	1.06 (0.85–1.32)	26.0	1.32 (1.04–1.69)	22.5	1.58 (1.10–2.28)	17.1	1.60 (1.08–2.38)	12.4	1.75 (1.06–2.91)
Both 50 or older	39.2	1.27 (0.96–1.69)	31.0	1.36 (1.00–1.85)	26.4	1.80 (1.14–2.84)	19.3	1.82 (1.11–2.99)	14.4	1.76 (1.01–3.08)
18–29/30–39	37.0	1.14 (0.92–1.41)	27.5	1.13 (0.85–1.51)	21.0	1.24 (0.86–1.78)	16.5	1.13 (0.73–1.74)	11.9	1.15 (0.71–1.85)

Table 3. Continued

Table 3. Continued

Household characteristics	1995–1996 (N <sup>a</sup> = 34,024)		1998–1999 (N = 31,670)		2001–2002 (N = 31,629)		2003 (N = 31,146)		2006–2007 (N = 28,685)	
	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI	No ban (%)	AOR and 95% CI
30–39/40–49	37.2	1.11 (0.89–1.39)	30.3	1.48 (1.15–1.90)	24.2	1.37 (0.94–1.99)	17.7	1.55 (1.02–2.34)	13.0	1.75 (1.04–2.93)
40–49/50 or older	35.7	1.21 (0.89–1.63)	29.1	1.43 (1.06–1.94)	22.8	1.31 (0.81–2.10)	17.6	2.06 (1.26–3.38)	15.1	1.88 (0.99–3.59)
Other combinations	45.3	1.21 (0.80–1.82)	37.8	1.48 (0.95–2.30)	30.5	1.93 (0.97–3.88)	22.9	2.27 (0.97–5.32)	14.7	1.34 (0.64–2.82)

Note. NH = Non-Hispanic; AOR = adjusted odds ratio.

<sup>a</sup>Discordant reports were regarded as the reference outcome.

<sup>b</sup>N represents the number of two-parent households in our sample for each survey period.

to prevent smoking uptake and promote smoking cessation among current and future generations of parents.

The trend observed in the level of parental concordance on home smoking ban reports and the associated household characteristics have also important implications for research methodology. The results suggest that researchers are in a better position using recent data to rely on a single parental report of the home smoking ban status today than they were 10 years ago. However, when it comes to households with current or former smokers, it is still recommended to take into account both parents' responses because our study indicates they are significantly more likely to provide discordant reports on their home smoking ban status.

## Limitations

This study is subject to several limitations. First, there were minor changes in the wording of the TUS-CPS home smoking ban question after 2002. While some people would interpret “in your home” and “inside your home” as equivalent expressions, the latter has more emphasis on the indoor environment. On the other hand, the newer version of the question asks about rules that apply not only to home residents but also visitors and workmen, thus making the definition of home smoking bans more restrictive. This suggests that our estimates of actual prevalence of a complete home smoking ban for the 2003 and 2006–2007 periods may have been affected in opposite directions by these changes in the wording of the question, and the magnitude and direction of the net effect is difficult to tell. In addition, the CPS recoded its race/ethnicity question. Starting in 2003, respondents were able to select more than one race. This change may affect our estimates regarding the association between race/ethnicity and home smoking ban reports. Unfortunately, the direction of this potential bias is unknown.

Second, a subset of the 2003 TUS-CPS data was longitudinal with respect to the 2001–2002 data (i.e., about one-third of respondents to the 2003 TUS-CPS had participated in the 2001–2002 survey round). There was a marked increase in the prevalence of a complete home smoking ban between 2001 and 2002 and 2003, considering the relatively shorter interval between the two surveys. It is possible this sharper increase was due in part to learning effects associated with previous participation in TUS-CPS. Hence, the results for that survey period may overestimate the real prevalence of home smoking bans and concordant parental reports in 2003. However, even excluding that survey period, the results suggest a clear trend toward decreasing rates of discordant parental reports and increasing rates of concordant complete home smoking ban reports over the period examined.

In conclusion, this study suggests increasing concordance of parental reports on home smoking bans and underscores the need to focus future interventions on households with current smokers to reduce SHS and THS exposure and protect the health of children in these households. Furthermore, our results demonstrate that household residents often disagree on their perceptions of their home smoking ban status and the importance of collecting data regarding home smoking bans from more than one individual in the home in order to obtain more reliable estimates of the prevalence and correlates of home smoking bans in the United States.

### Funding

This work was supported by National Institutes of Health/National Cancer Institute Training Tobacco Scientists Mini Grant (Grant #5 P50 CA143188) from University of Wisconsin Center For Tobacco Research and Intervention and by intramural support from the University of Wisconsin Carbone Cancer Center.

### Declaration of Interests

None declared.

### References

Albers, A. B., Biener, L., Siegel, M., Cheng, D. M., & Rigotti, N. (2008). Household smoking bans and adolescent antismoking attitudes and smoking initiation: Findings from a longitudinal study of a Massachusetts youth cohort. *American Journal of Public Health, 98*, 1886–1893. doi:10.2105/AJPH.2007.129320

Allison, P. D. (2000). Multiple imputation for missing data: A cautionary tale. *Sociological Methods and Research, 28*, 301–309. doi:10.1177/0049124100028003003

Apostolou, A., Garcia-Esquinas, E., Fadrowski, J. J., McClaine, P., Weaver, V. M., & Navas-Acien, A. (2011). Secondhand tobacco smoke: A source of lead exposure in U.S. children and adolescents. *American Journal of Public Health, 101*, 3001–3006. doi:10.2105/AJPH.2011.300161

Binns, H. J., O'Neil, J., Benuck, I., & Ariza, A. J. (2009). Influences on parents' decisions for home and automobile smoking bans in households with smokers. *Patient Education and Counseling, 74*, 272–276. doi:10.1016/j.pec.2008.09.001

Blackburn, C., Spencer, N., Bonas, S., Coe, C., Dolan, A., & Moy, R. (2003). Effect of strategies to reduce exposure of infants to environmental tobacco smoke in the home: Cross sectional survey. *British Medical Journal, 327*, 257. doi:10.1136/bmj.327.7409.257

Clark, P. I., Schooley, M. W., Pierce, B., Schulman, J., Hartman, A. M., & Schmitt, C. L. (2006). Impact of home smoking rules on smoking patterns among adolescents and young adults. *Preventing Chronic Disease, 3*, A41.

Ding, D., Wahlgren, D. R., Liles, S., Matt, G. E., Oliver, M., Jones, J. A., et al. (2011). A second reporter matters: Agreement between parents' and children's reports of smoking bans in families. *American Journal of Preventive Medicine, 40*, 572–575. doi:10.1016/j.amepre.2010.12.020

Gilpin, E. A., White, M. M., Farkas, A. J., & Pierce, J. P. (1999). Home smoking restrictions: Which smokers have them and how they are associated with smoking behavior. *Nicotine & Tobacco Research, 1*, 153–162. doi:10.1080/14622299050011261

Gonzales, M., Malcoe, L. H., Kegler, M. C., & Espinoza, J. (2006). Prevalence and predictors of home and automobile smoking bans and child environmental tobacco smoke exposure: A cross-sectional study of U.S.- and Mexico-born Hispanic women

with young children. *BMC Public Health, 6*, 265. doi:10.1186/1471-2458-6-265

Hyland, A., Higbee, C., Borland, R., Travers, M., Hastings, G., Fong, G. T., et al. (2009). Attitudes and beliefs about second-hand smoke and smoke-free policies in four countries: Findings from the International Tobacco Control Four Country Survey. *Nicotine & Tobacco Research, 11*, 642. doi:10.1093/ntr/ntp063

Johansson, A., & Halling, A. (2003). Does having children affect adult smoking prevalence and behaviours at home? *Tobacco Induced Diseases, 1*, 175–183. doi:10.1186/1617-9625-1-3-175

Kegler, M. C., Escoffery, C., Groff, A., Butler, S., & Foreman, A. (2007). A qualitative study of how families decide to adopt household smoking restrictions. *Family & Community Health, 30*, 328–341. doi:10.1097/01.FCH.0000290545.56199.c9

King, B. A., Hyland, A. J., Borland, R., McNeill, A., & Cummings, K. M. (2011). Socioeconomic variation in the prevalence, introduction, retention, and removal of smoke-free policies among smokers: Findings from the International Tobacco Control (ITC) Four Country Survey. *International Journal of Environmental Research and Public Health, 8*, 411–434. doi:10.3390/ijerph8020411

Klein, E. G., Forster, J. L., Erickson, D. J., Lytle, L. A., & Schillo, B. (2009). The relationship between local clean indoor air policies and smoking behaviours in Minnesota youth. *Tobacco Control, 18*, 132–137. doi:10.1136/tc.2007.024307

Levy, D. T., Romano, E., & Mumford, E. A. (2004). Recent trends in home and work smoking bans. *Tobacco Control, 13*, 258–263. doi:10.1136/tc.2003.006056

Malarcher, A., Shah, N., Tynan, M., Maurice, E., & Rock, V. (2009). State-specific secondhand smoke exposure and current cigarette smoking among adults—United States, 2008. *Morbidity and Mortality Weekly Report, 58*, 1232–1235.

Mantziou, V., Vardavas, C. I., Kletsiou, E., & Priftis, K. N. (2009). Predictors of childhood exposure to parental second-hand smoke in the house and family car. *International Journal of Environmental Research and Public Health, 6*, 433–444. doi:10.3390/ijerph6020433

Martinez-Donate, A. P., Hovell, M. F., Hofstetter, C. R., González-Pérez, G. J., Adams, M. A., & Kotay, A. (2007). Correlates of home smoking bans among Mexican-Americans. *American Journal of Health Promotion: AJHP, 21*, 229–236.

Martinez-Donate, A. P., Johnson-Kozlow, M., Hovell, M. F., & Gonzalez Perez, G. J. (2009). Home smoking bans and second-hand smoke exposure in Mexico and the US. *Preventive Medicine, 48*, 207–212. doi:10.1016/j.ympmed.2008.12.011

Mumford, E. A., Levy, D. T., & Romano, E. O. (2004). Home smoking restrictions. Problems in classification. *American Journal of Preventive Medicine, 27*, 126–131. doi:10.1016/j.amepre.2004.04.001

Rodriguez, D., Tscherne, J., & Audrain-McGovern, J. (2007). Contextual consistency and adolescent smoking: Testing the

indirect effect of home indoor smoking restrictions on adolescent smoking through peer smoking. *Nicotine & Tobacco Research*, 9, 1155–1161. doi:10.1080/14622200701648383

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys* (Vol. 519). Hoboken, NJ: Wiley Online Library.

Spencer, N., Blackburn, C., Bonas, S., Coe, C., & Dolan, A. (2005). Parent reported home smoking bans and toddler (18–30 month) smoke exposure: A cross-sectional survey. *Archives of Disease in Childhood*, 90, 670. doi:10.1136/adc.2004.054684

Trosclair, A., Babb, S., Murphy-Hoefer, R., Asman, K., Husten, C., & Malarcher, A. (2007). State-specific prevalence of smoke-free home rules—United States, 1992–2003. *Morbidity and Mortality Weekly Report*, 56, 501–504.

U.S. Department of Health and Human Services. (2007). *The health consequences of involuntary exposure to tobacco smoke: A report of the surgeon general*. Retrieved from <http://www.surgeongeneral.gov/library/secondhandsmoke/report/index.html>

Wakefield, M., Banham, D., Martin, J., Ruffin, R., McCaul, K., & Badcock, N. (2000). Restrictions on smoking at home and urinary cotinine levels among children with asthma. *American Journal of Preventive Medicine*, 19, 188–192. doi:10.1016/S0749-3797(00)00197-5

Winickoff, J. P., Friebely, J., Tanski, S. E., Sherrod, C., Matt, G. E., Hovell, M. F., et al. (2009). Beliefs about the health effects of “thirdhand” smoke and home smoking bans. *Pediatrics*, 123, e74. doi:10.1542/peds.2008-2184

Yousey, Y. K. (2006). Household characteristics, smoking bans, and passive smoke exposure in young children. *Journal of Pediatric Health Care*, 20, 98–105. doi:10.1016/j.pedhc.2005.08.006

Zhang, X., Martinez-Donate, A. P., Kuo, D., Jones, N. R., & Palmersheim, K. A. (2012). Trends in home smoking bans in the USA, 1995–2007: Prevalence, discrepancies and disparities. *Tobacco Control*, 21, 330–336. doi:10.1136/tc.2011.043802