



Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)



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ABSTRACT

Objective: To describe the voluntary adoption of smoke-free homes and social attitudes in Spain towards banning smoking in vehicles in which children are present.

Methods: Cross-sectional study of a representative sample of the adult Spanish population age range, 18–75 years (n = 1036). The field work was conducted via a computer-assisted telephone survey in March and April 2016. Survey respondents answered questions about smoking rules at home and attitudes towards a smoking ban in cars with or without children. Home smoking rules were defined as complete (smoking not allowed anywhere in the house), partial (smoking allowed in some areas inside the house) or absent (smoking allowed everywhere).

Results: Most (83.0%) of the surveyed population had some type of smoking restriction in place at home (45.6% complete and 37.5% partial). There were significant differences between groups according to age group (the highest prevalence was 86.1% from 66 to 75 years and the lowest prevalence was 77.8% from 46 to 65 years) and smoking status (the highest prevalence was 89.4% in people who had never been smokers and the lowest prevalence was 75.0% in current smokers) with regards to the prevalence of smoke-free homes (p < 0.05), with partial bans more prevalent in smoking households (49.0%). Most (61.6%) of the population favored banning smoking in cars, and 90.1% supported a ban in cars carrying minors. Attitudes towards smoking regulation in cars (with or without children) varied significantly by age group (the highest prevalence was 81.9% from 66 to 75 years and the lowest prevalence was 54.5% from 18 to 45 years) and smoking status (the highest prevalence was 71.4% in people who had never been smokers and the lowest prevalence was 46.0% in current smokers). However, no significant differences were found with regard to attitudes towards smoking regulation in cars carrying children, regardless of sex, age, social class, or smoking status.

Conclusion: Approximately half of the adult population in Spain have implemented a complete smoke-free rule at home. More than 9 out of 10 adults favor regulating smoking in cars in the presence of minors. These findings support the expansion of smoke-free regulations to include private vehicles, particularly when minors are in the car.

1. Introduction

Second-hand smoke (SHS) exposure has harmful health consequences because non-smokers exposed to SHS inhale the same damaging substances as active smokers (Oberg et al., 2011; U.S. Department of Health and Human Services, 2006; Strachan and Cook,

1997; Cook and Strachan, 1997). Children are more vulnerable to SHS because of their still-developing immune system, their faster breathing rate, and their inability (in some cases) to avoid the source (Semple et al., 2012, 2010; Rees and Connolly, 2006). SHS exposure has been associated with an increased risk of sudden infant death syndrome (Alm et al., 1998; Hawkins et al., 2016; Dybing and Sanner, 1999; Rees and

Abbreviations: aOR, adjusted Odds Ratio; CDC, Centers for Disease Control and Prevention; CI, Confidence Intervals; cOR, crude Odds Ratio; MUH, Multiunit Housing; Odds Ratio, OR; SHS, Secondhand Smoke; INE, Spanish National Institute of Statistics; US, United States of America; WHO, World Health Organization

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Connolly, 2006) and an increase in respiratory diseases such as asthma, persistent wheezing (Cheraghi and Salvi, 2009; Lewis et al., 1995; Tsai et al., 2010; Hawkins et al., 2016; Rees and Connolly, 2006), and otitis media in children (Dybing and Sanner, 1999; Oberg et al., 2011; Rees and Connolly, 2006; Adair-Bischoff and Sauve, 1998).

It is well-known that there is no safe level of SHS exposure (U.S. Department of Health and Human Services, 2006); consequently, in the last decade many countries have implemented laws to protect non-smokers from SHS exposure in indoor workplaces and public places (Oberg et al., 2011; U.S. Department of Health and Human Services, 2006; Guangyuan Liu et al., 2014). Moreover, there is a growing body of evidence indicating that the implementation of smoke-free laws has not—as one might suspect—led to an increase in tobacco use in private settings such as homes or cars (Jarvis et al., 2012; Martínez-Sánchez et al., 2014). Rather, the available evidence suggests that implementation of anti-smoking legislation is associated with a decrease in children's SHS exposure and with an increase in the percentage of smoke-free homes (Martínez-Sánchez et al., 2014; Sims et al., 2012; Jarvis et al., 2012; Lidón-Moyano et al., 2016). Similarly, smoke-free legislation seems to have had a positive impact on the pediatric population (Mackay et al., 2010, 2012; Been et al., 2015, 2014; Millett et al., 2013), as evidenced by reported health benefits associated with smoke-free bans in several countries, including a lower asthma-related hospital admission rate (Mackay et al., 2010; Millett et al., 2013) and a decrease in the rate of preterm births (Been et al., 2014; Mackay et al., 2012).

Despite this progress, many children are still exposed to SHS in private settings (predominantly in homes and cars) (Halterman et al., 2006). These places, where, after school, children spend much of their time, remain somewhat controversially unregulated. At present, there is an open debate on whether smoke-free legislation should be extended to private settings, with some suggesting that this could further reduce the social acceptability of public tobacco use, thereby promoting smoking cessation efforts and positively benefitting the health of the entire population (Kruger et al., 2015; Hopkins et al., 2010; USDHHS, 2012; Pizacani et al., 2004). In this sense, there is growing evidence that children living in homes with absolute smoking bans have lower levels of urinary cotinine (Wakefield et al., 2000; Blackburn et al., 2003).

In Spain, the current law governing smoking (Law 42/2010) (Gobierno de España, 2010) explicitly prohibits smoking in any enclosed space within any communal areas (elevators, hallways, stairs, etc.). However, this law leaves the decision to prohibit smoking in open spaces (common patios, terraces, gardens, swimming pools) not designated as children's areas to the board of owners (Law 42/2010) (Gobierno de España, 2010).

Given this context, the objective of the present study was to assess and describe the prevalence of smoke-free homes in Spain and to evaluate social attitudes towards regulating tobacco use in vehicles with or without children.

2. Methods

This was a cross-sectional study of a representative sample of the Spanish adult population between 16 and 75 years of age ($n=1045$). For this study, we have excluded those under 18 years old ($n=9$) because they would not be able to purchase cigarettes legally, they would have less decision-making in the smoking policy in the home, and in terms of smoking in motor vehicles with a minor they would be considered minors. The final sample for this study was 1036 participants.

We used data from the ÓMNIBUS survey from the DYM Institute (DYM, 2015). The sample size was calculated using the simple random sampling formula ($N = ((Z\alpha/2 \cdot p \cdot (1-p))/e^2)$), using a 50% estimated prevalence (p ; prevalence that maximizes the sample size), a 95% confidence level ($\alpha = 0.05$) ($Z\alpha/2 = 1.96$) and a precision of 3.15%. The ÓMNIBUS survey is a cross-sectional study with more than one variable of interest. For this reason, the estimated prevalence is 50% to

maximize the sample size and the power, although the prevalence of the different variables could be higher or lower. In this sense, having a greater sample size maximizes the external validity of the estimation. However, the precision used (3.15%) is lower than the precision commonly used in the National Health Surveys (precision between 2% and 2.5%) in order to increase the feasibility of the fieldwork. In this sense, increasing the precision (from 2.5% to 3.15%) affects the increase in the amplitude of the confidence interval. The survey was conducted in March and April 2016 using computer-assisted telephone interviews in Spanish. Households were randomly selected for interviews from municipal telephone directories. The interviewee was selected according to quotas based on age, sex, and work activity; this was necessary to ensure a final sample weighted by study design weights (inverse probability) based on the distribution of the data obtained by the Spanish National Institute of Statistics (INE) to obtain a greater representation of Spain. The weighting was performed by sex, age, area of residence (i.e., East, South, etc.), size of municipality of residence, and occupation.

2.1. Variables

We obtained information from the survey respondents ($n=1036$) about the voluntary implementation of smoke-free homes and about attitudes towards a smoking ban in common areas of multiunit housing (MUH) buildings (e.g.: apartments, flats, building, etc.) and in vehicles (with or without children).

2.1.1. Smoke-free home

To estimate the prevalence of smoke-free homes, we asked the following question: "Which of the following situations best describes the smoking rules inside your house? 1) 'Nobody can smoke'; 2) 'You can only smoke in some places'; or 3) 'You can smoke everywhere'. Based on the responses to this question, we defined household smoking rules as complete (smoking not allowed inside or connected outdoor areas of the house), partial (smoking allowed in some places inside or in connected outdoor areas of the house), or absent (smoking allowed everywhere inside the house). We then dichotomized this variable as 'rules' vs. "no rules" to indicate, respectively, the existence of some kind of smoking rules (complete or partial) or no smoking rules in the house.

2.1.2. Attitudes towards smoking regulations in common areas (i.e. elevator, stairs, walkways, etc.) of MUH

We measured attitudes towards smoking regulation in common areas using the following question: "Should smoking be prohibited within the common areas (i.e.: elevator, stairs, lobby, walkways, etc.) of MUH, with six possible answers: "totally agree", "agree", "neither agree nor disagree", "disagree", "totally disagree", "don't know/no answer". We recoded this variable according to whether the respondents agreed with regulating smoking ("totally agree" and "agree"), disagreed (disagree" and "totally disagree"), and neither agree nor disagree ("neither agree nor disagree"). We asked all participants this question regardless of where they lived (flat, multiunit housing, house, etc.).

2.1.3. Attitudes towards smoking regulations in vehicles

We assessed attitudes towards regulating smoking in cars in general and in cars carrying children (minors). Smoking "in the presence of a child" was defined as smoking inside a vehicle where a minor under 18 was present. We asked the following two questions: "Should smoking be prohibited inside cars in the presence of minors?" and "Should smoking be prohibited inside cars, without exception?". The possible answers for both questions were: "totally agree", "agree", "neither agree nor disagree", "disagree", "totally disagree", "don't know/no answer". Again, we recoded this variable according to whether the respondents agreed with regulating smoking ("totally agree" and "agree"), disagreed (disagree" and "totally disagree"), and neither agree nor disagree ("neither agree nor disagree").

2.2. Statistical analysis

We calculated the percentages for responses about: a) the voluntary implementation of smoke-free homes; b) attitudes towards smoking regulation in house common areas; and c) attitudes towards smoking regulation in cars (with and without minors). Respondents who answered "don't know / no answer" were excluded from the analysis. All responses were stratified by the following categories: sex; age (categorized as young adults, aged 18–45 years; adults, age 46–65; and elderly, age 66–75); social class (categorized into high, medium, and low according to the educational level of the respondent and the occupation of the primary provider in the family); educational level (categorized as primary or lower (no qualification up to middle school diploma), secondary or intermediate (high school) and university or higher (university degree)); inhabitants (< 20.000; from 20.000 to 250.000, > 250.000); geographical area (north, center, south); and cigarette smoking status (categorized as "current smoker", defined as daily or occasional smokers at the time the survey was conducted; "former smoker", which were participants who did not smoke cigarettes at the time of the survey but who had smoked cigarettes in the past; and "never-smokers", participants who had never smoked cigarettes). We compared the prevalence using a Chi Square test. We also calculated the crude odds ratios (cOR) with 95% confidence intervals (CI) and the adjusted OR (aOR) for sex, age, inhabitants, and social class. For the attitudes to the regulation we fitted a multinomial regression model using category of disagree as a reference in order to calculate the ORc and ORa. Data analyses were performed using the SPSS statistical software program, version 21. In addition, all statistical analyses were weighted in accordance with the sample design.

3. Results

Table 1 shows the prevalence of some type of smoke-free home classified by the participants' demographic and social characteristics.

Table 1
Prevalence of smoke-free homes in Spain (2016).

	n	Any type of rules (complete and partial)			Complete rules			Partial rules		
		%	95% CI	p-value	%	95% CI	p-value	%	95% CI	p-value
Overall	1036	83.0	80.6 – 85.2	–	45.6	42.5 – 48.7	–	37.5	34.5 – 40.5	–
Sex				0.362			0.203			0.037
Men	515	82.0	78.2 – 85.1		47.7	43.3 – 52.1		34.2	30.1 – 38.5	
Women	521	84.2	80.7 – 87.2		43.5	39.2 – 48.0		40.7	36.4 – 45.0	
Age group (Years)				0.004			0.002			0.048
18–45	547	85.9	82.6 – 88.6		46.3	42.1 – 50.6		39.6	35.5 – 43.8	
46–65	367	77.8	73.1 – 81.9		40.2	35.2 – 45.4		37.6	32.7 – 42.8	
66–75	105	86.1	78.4 – 91.5		58.5	49.2 – 67.3		27.6	20.1 – 36.6	
Social class				0.751			0.128			0.077
Low	111	80.7	71.9 – 87.4		50.7	41.1 – 60.3		30.0	21.8 – 39.5	
Medium	745	83.1	80.2 – 85.7		43.6	40.1 – 47.3		39.5	36.0 – 43.1	
High	180	84.1	77.8 – 89.0		50.5	43.0 – 58.0		33.6	26.8 – 41.0	
Educational level				0.113			0.676			0.552
Low	317	81.1	76.3 – 85.2		43.6	38.1 – 49.3		37.5	32.2 – 43.1	
Medium	374	86.3	82.3 – 89.5		47.0	41.8 – 52.2		39.3	34.4 – 44.5	
High	344	81.3	76.7 – 85.2		45.9	40.6 – 51.3		35.4	30.4 – 40.7	
Inhabitants				0.899			0.210			0.128
< 20.000	329	82.3	77.7 – 86.6		45.9	40.4 – 51.4		36.4	31.3 – 41.9	
20.000–250.000	380	83.1	78.9 – 86.6		48.5	43.4 – 53.7		34.6	29.9 – 39.6	
> 250.000	327	83.7	79.1 – 87.4		41.9	36.5 – 47.5		41.8	36.4 – 47.3	
Geographic area				0.158			0.176			0.160
North	327	84.0	79.5 – 87.7		49.8	44.3 – 55.4		34.2	29.1 – 39.7	
Center	494	84.3	80.7 – 87.3		43.9	39.5 – 48.4		40.4	36.1 – 44.9	
South	215	78.7	72.5 – 83.8		43.1	36.5 – 50.1		35.5	29.2 – 42.4	
Tobacco smoking				< 0.001			< 0.001			< 0.001
Current smokers	275	75.0	69.4 – 79.9		26.0	21.0 – 31.7		49.0	43.0 – 55.1	
Former smokers	315	81.1	76.3 – 85.2		50.3	44.7 – 56.0		30.8	25.8 – 36.3	
Never-smokers	446	89.4	86.0 – 92.0		54.4	49.6 – 59.0		35.0	30.6 – 39.7	

CI: Confidence intervals.

Most participants (83.0%; 95% CI: 80.6–85.2) declared having adopted some type of smoke-free rules at home (complete ban in 45.6% and partial ban in 37.5%). 58.5% (95% IC: 49.2–67.3) of participants in the older age group had complete rules versus 27.6% (95% IC: 20.1–36.6) with partial rules. In addition, there is also a higher percentage of complete rules than partial among never smokers (54.4% versus 35%, $p < 0.05$) (Table 1). The differences according to smoking status in the age-adjusted prevalences were also higher among never smokers (data not shown). After adjusting for sex, age, inhabitants, and social class, the same patterns remained significant.

Slightly less than half (45.6%; 95%CI: 42.5–48.7) of the participants reported having adopted a complete smoke-free home, although with significant differences by age group and smoking status (Tables 1, 2). Partial smoking bans were implemented in 37.5% (95% CI: 34.5–40.5) of households, with significant differences according to age group. The highest prevalence of partial smoking ban was found in the younger age group (18–45 years) with a 39.6% (95%CI: 35.5–43.8) and the lowest was found in the older age group (66–75 years) with a 27.6% (95%CI: 20.1–36.6). Significant differences of partial smoking ban were also found for smoking status; being 49.0% (95%CI: 43.0–55.1) in current smokers and 30.8% (95%CI: 25.8–36.3) in former smokers (Tables 1, 2). The percentage of homes of current smokers with a partially smoke-free home was significantly higher than smoking households with completely smoke-free homes (49.0% vs. 26.0%, $p < 0.05$). The odds ratios (ORc and ORa) were consistent with this finding (Table 2). No statistically significant differences were found according to social class, educational level, inhabitants and geographical area.

85.7% of participants declared to be in favor of banning smoking in common areas of buildings, while 6.6% disagree, and 7.7% responded to neither agree nor disagree. Table 3 shows the percentage of respondents in favor of banning smoking in common areas of buildings according to independent variables. There were statistically significant differences in the percentages of people who

Table 2
Association between smoke-free homes and sociodemographic variables in Spain (2016).

	n	Any type of rules (complete and partial)				Complete rules				Partial rules			
		cOR	95%CI	aOR	95%CI	cOR	95%CI	aOR	95%CI	cOR	95%CI	aOR	95%CI
Sex													
Men	515	ref.	–	ref.	–	1.2	0.9 – 1.5	1.2	0.9 – 1.6	ref.	–	ref.	–
Women	521	1.2	0.8 – 1.7	1.2	0.8 – 1.7	ref.	–	ref.	–	1.3	1.0 – 1.7	1.3	1.0 – 1.8
Age group (years)													
18–45	547	1.7	1.2 – 2.5	1.7	1.2 – 2.5	1.3	1.0 – 1.7	1.3	1.0 – 1.7	1.7	1.1 – 2.8	1.7	1.0 – 2.8
46–65	367	ref.	–	ref.	–	ref.	–	ref.	–	1.6	1.0 – 2.6	1.6	0.9 – 2.6
66–75	105	1.8	1.0 – 3.1	1.8	1.0 – 3.3	2.1	1.4 – 3.3	2.1	1.3 – 3.3	ref.	–	ref.	–
Social class													
Low	111	ref.	–	ref.	–	1.3	0.9 – 2.0	1.2	0.8 – 1.8	ref.	–	ref.	–
Medium	745	1.2	0.7 – 2.0	1.3	0.7 – 2.5	ref.	–	ref.	–	1.5	1.0 – 2.4	1.4	0.9 – 2.2
High	180	1.3	0.7 – 2.4	1.3	0.7 – 2.5	1.3	0.9 – 1.9	1.3	0.9 – 1.9	1.2	0.7 – 2.0	1.7	0.6 – 1.8
Educational level													
Low	317	ref.	–	ref.	–	ref.	–	ref.	–	1.1	0.8 – 1.5	1.3	0.9 – 1.8
Medium	374	1.5	1.0 – 2.2	1.4	0.9 – 2.2	1.1	0.8 – 1.6	1.3	0.9 – 1.8	1.2	0.8 – 1.6	1.2	0.8 – 1.6
High	344	1.01	0.7 – 1.5	0.9	0.6 – 1.4	1.1	0.8 – 1.5	1.2	0.8 – 1.7	ref.	–	ref.	–
Inhabitants													
< 20.000	329	ref.	–	ref.	–	1.2	0.9 – 1.6	1.2	0.9 – 1.7	1.1	0.8 – 1.5	1.1	0.8 – 1.5
20.000–250.000	380	1.1	0.7 – 1.6	1.1	0.7 – 1.6	1.3	1.0 – 1.8	1.4	1.0 – 1.9	ref.	–	ref.	–
> 250.000	327	1.1	0.7 – 1.6	1.1	0.7 – 1.6	ref.	–	ref.	–	1.4	1.0 – 2.0	1.4	1.0 – 2.0
Geographic area													
North	327	1.4	0.9 – 2.3	1.5	0.9 – 2.4	1.3	0.9 – 1.9	1.4	1.0 – 2.1	ref.	–	ref.	–
Center	494	1.5	1.0 – 2.2	1.4	0.9 – 2.2	1.0	0.7 – 1.5	1.1	0.7 – 1.5	1.3	1.0 – 1.8	1.3	1.0 – 1.8
South	215	ref.	–	ref.	–	ref.	–	ref.	–	1.1	0.7 – 1.6	1.1	0.8 – 1.7
Tobacco smoking													
Current smokers	275	ref.	–	ref.	–	ref.	–	ref.	–	2.2	1.5 – 3.1	2.1	1.5 – 3.0
Former smokers	315	1.4	0.9 – 2.2	1.5	1.0 – 2.3	2.9	2.0 – 4.2	2.9	2.0 – 4.2	ref.	–	ref.	–
Never-smokers	446	2.8	1.8 – 4.3	2.7	1.7 – 4.1	3.4	2.4 – 4.8	3.4	2.3 – 4.8	1.2	0.9 – 1.7	1.2	0.8 – 1.6

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

Table 3
Prevalence of respondents who support regulations to prohibit smoking in common areas of multihousing units in Spain (2016).

	n	Support regulation smoking in Commons areas							
		%	95% CI	p-value	cOR	95%CI	aOR	95%CI	
Overall	1036	85.7	83.4 – 87.8	–	–	–	–	–	
Sex									
Men	515	85.5	82.1 – 88.4	0.448	ref.	–	ref.	–	
Women	521	85.9	82.5 – 88.7		1.4	0.8 – 2.5	1.4	0.8 – 2.5	
Age group (years)									
18–45	547	85.2	81.8 – 88.0	0.694	ref.	–	ref.	–	
46–65	367	86.3	82.2 – 89.5		1.2	0.6 – 2.2	1.2	0.7 – 2.2	
66–75	105	86.5	78.9 – 91.8		2.0	0.7 – 5.3	2.3	0.8 – 6.5	
Social class									
Low	111	77.9	68.9 – 85.0	0.292	ref.	–	ref.	–	
Medium	745	86.3	83.6 – 88.7		1.6	0.7 – 3.7	1.8	0.8 – 4.3	
High	180	88.0	82.1 – 92.2		2.5	0.9 – 7.0	2.9	1.0 – 8.4	
Educational level									
Low	317	80.3	75.4 – 84.4	0.014	ref.	–	ref.	–	
Medium	374	87.0	83.1 – 90.0		1.8	1.0 – 3.5	2.6	1.1 – 6.1	
High	344	89.3	85.4 – 92.2		2.5	1.1 – 5.7	2.0	1.0 – 4.0	
Inhabitants									
< 20.000	329	81.9	77.2 – 85.8	0.239	ref.	–	ref.	–	
20.000–250.000	380	87.4	83.5 – 90.4		1.1	0.5 – 2.1	1.0	0.5 – 2.0	
> 250.000	327	87.7	83.5 – 90.9		1.5	0.8 – 2.9	1.4	0.7 – 2.7	
Geographic area									
North	327	88.5	84.45 – 91.7	0.122	1.7	0.8 – 3.2	1.6	0.8 – 3.1	
Center	494	83.3	79.6 – 86.4		ref.	–	ref.	–	
South	215	87.0	81.5 – 91.0		1.9	0.9 – 4.3	2.3	1.0 – 5.2	
Tobacco smoking									
Current smokers	275	81.0	75.8 – 85.4	0.023	ref.	–	ref.	–	
Former smokers	315	86.3	81.9 – 89.8		2.5	1.1 – 5.4	1.4	0.9 – 2.2	
Never-smokers	446	88.2	84.7 – 91.0		1.8	0.9 – 3.4	1.7	0.9 – 3.3	

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

Table 4
Percentage and OR of respondents who are in favor of regulating smoking in vehicles with and without children in Spain (2016).

	In cars with children							In all cars (with or without children)							
	n	%	95% CI	p-value	ORc	95%CI	ORa	95%CI	%	95% CI	p-value	ORc	95%CI	ORa	95%CI
Overall	1036	90.1	88.1 – 91.8	–	–	–	–	–	61.6	58.6 – 64.6	–	–	–	–	–
Sex				0.770							0.013				
Men	515	89.6	86.5 – 92.0		ref.	–	ref.	–	59.9	55.5 – 64.2		ref.	–	ref.	–
Women	521	90.6	87.7 – 92.9		1.4	0.7 – 2.9	1.4	0.7 – 2.9	63.3	59.0 – 67.6		1.6	1.1 – 12.2	1.6	1.1 – 2.2
Age group (years)				0.443							< 0.001				
18–45	547	89.1	86.2 – 91.2		ref.	–	ref.	–	54.5	50.2 – 58.7		ref.	–	ref.	–
46–65	367	90.6	87.0 – 93.3		0.9	0.4 – 1.9	0.9	0.4 – 2.0	65.5	60.4 – 70.3		1.4	1.0 – 2.1	1.5	1.0 – 2.1
66–75	105	92.9	86.4 – 96.6		1.8	0.5 – 6.6	2.3	0.6 – 8.9	81.9	73.7 – 88.1		5.4	2.4 – 12.2	5.4	2.3 – 12.6
Social class				0.125							0.845				
Low	111	85.6	77.4 – 91.3		ref.	–	ref.	–	59.3	49.5 – 68.4		ref.	–	ref.	–
Medium	745	90.1	87.7 – 92.1		2.1	0.9– 5.02	2.3	0.9 – 6.0	62.4	58.8 – 65.9		0.7	0.4 – 1.3	0.9	0.5 – 1.7
High	180	92.8	87.8 – 96.0		6.6	1.5 – 27.9	7.5	1.7 – 33.7	60.0	52.5 – 67.2		0.8	0.4 – 1.6	1.0	0.5 – 2.1
Educational level				0.010							0.448				
Low	317	87.3	83.0 – 90.6		ref.	–	ref.	–	64.8	59.3 – 70.0		1.	0.9 – 2.1	1.1	0.7 – 1.8
Medium	374	89.4	85.7 – 92.2		2.3	1.0 – 5.3	2.3	0.9 – 6.0	61.4	56.3 – 66.3		1.1	0.7 – 1.6	1.1	0.7 – 1.7
High	344	93.5	90.2 – 95.8		3.4	1.4 – 8.2	3.0	1.1 – 8.0	58.9	53.5 – 64.1		ref.	–	ref.	–
Inhabitants				0.872							0.743				
< 20.000	329	89.4	85.4 – 92.4		ref.	–	ref.	–	62.1	56.8 – 67.5		1.0	0.7 – 1.5	1.1	0.7 – 1.6
20.000–250.000	380	90.2	86.7 – 93.0		1.3	0.5 – 3.0	1.2	0.5 – 2.9	62.8	57.7 – 67.7		0.9	0.6 – 1.4	0.9	0.6 – 1.3
> 250.000	327	90.7	86.9 – 93.5		1.5	0.7 – 3.3	1.3	0.6 – 3.0	59.6	54.0 – 64.9		ref.	–	ref.	–
Geographic area				0.137							0.295				
North	327	92.0	88.3 – 94.6		1.5	0.7 – 3.6	1.5	0.6 – 3.6	64.9	59.5 – 70.0		1.3	0.9 – 2.0	1.3	0.9 – 1.9
Center	494	88.3	85.1 – 90.9		ref.	–	ref.	–	58.8	54.3 – 63.1		ref.	–	ref.	–
South	215	91.4	86.6 – 94.6		1.0	0.4 – 2.5	1.2	0.5 – 3.0	63.2	56.3 – 69.6		1.4	0.9 – 2.3	1.5	0.9 – 2.5
Tobacco smoking				0.040							< 0.001				
Current smokers	275	85.5	80.7 – 89.4		ref.	–	ref.	–	46.0	40.0 – 52.1		ref.	–	ref.	–
Former smokers	315	91.4	87.6 – 94.2		1.2	0.5 – 3.2	1.1	0.5 – 2.9	61.4	55.8 – 66.8		2.4	1.5 – 3.7	2.2	1.4 – 3.4
Never-smokers	446	92.0	88.9 – 94.2		1.1	0.5 – 2.6	1.1	0.4 – 2.4	71.4	66.9 – 75.5		4.3	2.8 – 6.7	4.2	2.7 – 6.4

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

declared to be in favor of banning smoking in common areas of buildings according to educational level and smoking status (Table 3).

90.1% of participants declared to be in favor of banning smoking in cars with children on board, 4.6% of respondents disagree, and 5.3% responded to neither agree nor disagree. Table 4 shows the percentage of respondents in favor of banning smoking in vehicles with children and in all cars (with or without children). No statistically significant differences in the percentages of people who declared to be in favor of banning smoking in presence of children were found among the various sociodemographic categories except smoking status and educational level (Table 4). The strongest support for this ban in cars with children was in never-smokers (92.0%; 95%CI: 88.9–94.2) and among people with high educational level (93.5%; 95%CI: 90.2–95.8). Additionally, 61.6% of participants declared to be in favor of banning smoking in cars without exceptions (with or without children on board), 22.0% respondents disagree, and 16.4% responded to neither agree nor disagree. Statistically significant differences of people who declared to be in favor of banning smoking in cars without exceptions were found by sex, age group and smoking status (Table 4). The strongest support for this ban in cars without exceptions was among women population (63.3%; 95%CI: 59.0–67.6), the oldest population group (66–75 years old; 81.9%, 95%CI: 73.7–88.1) and never-smokers (71.4%; 95% CI: 66.9–75.5).

4. Discussion

In Spain, more than 8 in 10 households have voluntarily adopted some type of smoke-free rules in their homes. More than half of all households, and 25% of smokers, have adopted a complete ban on smoking at home. Moreover, the vast majority (90%) of the adult population support banning smoking in cars carrying minors. These results are relevant given that private settings such as homes and vehicles

are the largest source of SHS exposure among the pediatric population (Haltermann et al., 2006; Mbulo et al., 2016) and in many countries (including Spain) there are currently no laws in place to control smoking in such settings.

In this study, we found a higher prevalence of smoke-free homes (complete or partial) among people who had never smoked. This pattern is consistent with previous studies carried out in the general population from various European countries and the United States (US) (King et al., 2013; Mons et al., 2013; St. Claire et al., 2012). Mons et al. (Mons et al., 2013) found a higher prevalence of smoke-free homes among the older population, results that are only consistent with our findings for complete rules. This finding could be attributable to the fact that, in Europe and especially in Spain, the prevalence of former or never-smokers is higher in the elderly than in the younger population (Sanidad, 2011). In our study, the percentage of completely smoke-free homes was almost half of the percentage reported by King and colleagues (King et al., 2013) for all sociodemographic variables. This could be partially explained because in our study the older population could have been underestimated (they constitute around 10% of the sample and we have no information about people over 75 years old). On the other hand, another potential explanation could be the different tradition of anti-tobacco legislation in the US in comparison with Spain, being implemented more recently in Spain (complete smoke-free legislation came into effect in 2011) than in the US (more than 20 years ago). The differences between the two studies were especially pronounced among the oldest population. Our results are in line with other authors studies previously (Mons et al., 2013; King et al., 2013) that found that current smokers accounted for the highest percentage of households with partial bans, probably because even though smokers need a place to smoke, social awareness of the harmful effects of SHS exposure has increased in recent years, thus prompting even smokers to place some restrictions on smoking in the home.

The prevalence of partial smoke-free rules among respondents of

child-bearing age, between 18 and 45 years old, was high in both sexes. We found that in this age group there is a high prevalence of smokers (29%). Moreover, this is especially remarkable, since it is also has the highest prevalence of current smokers in this age group in Spain (Sanidad, 2011). It seems probable that this support for a partial ban is due to the presence of children, for whom SHS exposure is perceived as most harmful. Unfortunately, we do not have information on the presence of children at home. However, a previous study has observed that the presence of young children in a household was a strong predictor of smoking bans at home with a pronounced dose-response relationship with the age of children (Mons et al., 2013). For this reason, pediatricians should promote the implementation of complete smoke-free home rules. Clearly, the never-smokers are those most likely to have a smoke-free home. Unlike other studies (King et al., 2013), we found no significant differences between social classes, nor did we find any differences by, level of education, or region. It is worth noting that social class could be a proxy for educational level and thus these two variables are unlikely to show differences. On the other hand, the smoking status of other members of the household could affect the voluntary adoption of smoke-free homes. Unfortunately, we do not have information about this variable. Future studies could address this topic.

The percentage of households with smoke-free rules has grown exponentially in the US in the last 20 years, from 43.1% in 1992 to 81.1% in 2010 (King et al., 2013). These changes are attributable to several factors, including the enactment of laws prohibiting smoking in public and work places, together with the resulting changes in the social acceptability of smoking. In fact, some studies have shown that smoke-free policies in public settings promote the voluntary adoption of, and support for, smoke-free homes (Cheng et al., 2011; Fong et al., 2006). In addition, it has been shown that voluntary smoke-free homes are associated with smokers attempting to quit, and that this may help them to quit (Pizacani et al., 2004). Furthermore, the available evidence demonstrates that the implementation of smoke-free legislation in public places and workplaces does not increase tobacco use in private settings (houses and cars) (Martínez-Sánchez et al., 2014; Jarvis et al., 2012). Therefore, a benefits of individual/voluntary interventions designed to protect children from tobacco smoke exposure is clear; nevertheless, population-level measures are needed to obtain greater benefits (Rosen et al., 2015, 2014).

Spanish smoking legislation, Law 42/2010 (Gobierno de España, 2010), which came into force in Spain in January 2011, prohibits smoking in common enclosed areas of buildings but leaves it to the community of neighbors to decide to prohibit smoking in open spaces not designated as children's areas. The present study was conducted five years after the passage of this law. We found strong support for this type of regulation, in particular by the elderly and the highest educational level groups. This support is likely to be due to the well-established relationship between higher level of studies and a greater awareness of the impact of SHS exposure. Additionally, the governments' efforts should be focused on social education about the dangers of smoking habits.

In recent years, smoke-free MUH (completely smoke-free buildings, including both private and common areas) has proliferated in the US and in several European countries (U.S. Department of Health and Human Services. & Prevention 2011; Snyder et al., 2015; Koster et al., 2012). The emergence of these housing units is likely because this is the only way to completely avoid tobacco smoke from neighbors (U.S. Department of Health and Human Services. & Prevention 2011; Snyder et al., 2015; Koster et al., 2012). Likewise, certain regions in the US, such as California (State of California, 2016), NY city, and Chicago have extended smoking prohibitions even further by banning smoking on beaches and in parks (Council, 2011; The Board of Commissioners of the Chicago Park District, 2014). It appears that these types of regulations are spreading, as exemplified by the June 2016 smoking ban in reservoirs and parks in Singapore (Government, 2016). In Spain, one measure the government could take would be to prohibit tobacco use in

public housing units (in Spanish: vivienda de protección oficial: VPO) as an initial measure to protect people from SHS exposure at home.

After houses, cars are the most common source of SHS exposure among children (Haltermann et al., 2006). Cars are a potentially serious source of SHS exposure given that concentrations of pollutants from cigarette smoke can accumulate rapidly in confined spaces (Murphy-Hoefer et al., 2014; Jones et al., 2009). Moreover, nicotine concentrations inside motor vehicles are much higher than air nicotine concentrations measured in public or private indoor places (Jones et al., 2009). Fine particulate matter, such as PM 2.5, is used as a marker of SHS exposure concentrations, especially in places where there are no other sources of combustion (Hyland et al., 2008; Semple et al., 2010). The World Health Organization (WHO) recommends that PM 2.5 air quality guidance levels of 25 µg/m³ be applied to indoor environments (Penney et al., 2010). In studies carried out in Canada, the UK, and New Zealand to assess PM 2.5 levels in cars with smokers, the levels exceed WHO recommendations (Semple et al., 2012; Ott et al., 2008; Rees and Connolly, 2006; Sendzik et al., 2009; Edwards et al., 2006). For these reasons, several countries have implemented regulations to prohibit smoking in cars in the presence of children (Canadian Cancer Society, 2014; World Health Organization, 2017; Christopher et al., 2015; Deutscher Bundestag, 2015).

In Spain, smoking in cars is currently unregulated. However, our study shows that 90% of the population supports smoke-free laws in cars in the presence of children. It is noteworthy that 86% of current smokers also support such regulations. In countries that have banned smoking in cars carrying children, the percentage of smokers and non-smokers who supported such laws prior to implementation was very high, a finding that is consistent with our study (Hitchman et al., 2011). Moreover, several studies have shown that positive attitudes towards smoke-free legislation increase after implementation (Fong et al., 2006; Murphy-Hoefer et al., 2014; Cheng et al., 2011). In England, smoking in vehicles in the presence of children was prohibited in 2015 (Department of Health, 2015). Given this context, our results suggest that the introduction of smoking bans to protect children from the health risks of SHS exposure in cars is likely to be supported by the majority of the population (more than 90%). In 2014, the Centers for Disease Control and Prevention (CDC) published the results of a study on the prevalence of smoke-free cars in Maine after a ban on smoking in cars was implemented, with significant reductions in prevalence after the law was passed (Murphy-Hoefer et al., 2014). Moreover, the percentage of smoke-free homes increased significantly after passage of that legislation (Murphy-Hoefer et al., 2014; Hitchman et al., 2011).

Smoking while driving has been widely recognized as the second most common cause of distraction while driving and there is growing evidence about the negative impact of such distraction on motor vehicles accidents (Wang et al., 1995; Stutts et al., 2001; Mcevoy et al., 2007 Sullman, 2012; Prat et al., 2015; Mangiaracina and Palumbo, 2006; Wen et al., 2005; Martínez-sánchez et al., 2012; Bakiri et al., 2013). In our study, although the attitudes towards smoking regulation in cars carrying children were high among smokers, smokers also (un-surprisingly) showed the lowest support for completely banning all smoking in cars. The public should be better informed about the risk of smoking as a distraction, and road safety laws and regulations need to be updated to reflect these risks.

The main limitations of this study are those derived from the use of surveys (Rada, 2004), the use of a computerized questionnaire by telephone interview could potentially threaten the internal validity of the study due to information bias. Although tobacco consumption in Europe and Spain could be partially socially stigmatized (Evans-Polce et al., 2015), we consider that the social desirability bias could be minimal in our study. However, our results could partially overestimate the prevalence of complete rules when smokers visit houses with complete rules and are exceptionally allowed to smoke. Another limitation of the study is the potential selection bias due to telephone directory sampling. In Spain, according to the "National Commission of

Markets and Competition" (CNMC) (Comisión Nacional de los Mercados y la Competencia, 2016) in 2015, there were almost 13.5 million landline residential telephones (around 74% of Spanish households). However, we do not have data stratified by social class or by age to evaluate. It could be possible that low social class have a lower percentage of landlines. In terms of strengths, the main strength is the use of a representative sample of the Spanish adult population. In addition, all analyses used weighted data of the Spanish population, thus increasing the external validity of the study.

In conclusion, the Spanish population seems to overwhelmingly support regulating smoking in vehicles carrying children. In addition, a non-negligible percentage of households (around half of the population) in Spain has a complete smoke free rule at home and more than 80% have either partially or completely smoke-free homes (37% partial rule). Although, the percentage of any kind of rule is high, partial rules are insufficient to protect children from SHS, for this reason, additional efforts are needed to promote and implement complete rules in homes in Spain. Given these findings, we believe that governments should strive to bring greater attention to the public about the negative health effects of SHS exposure. In addition, regulations should be strengthened to protect children and more studies are needed to establish the economic and public health impact.

Competing interests

The authors declare that they have no conflicts of interest.

Contributors' Statements

JMMS conceptualized and designed the study. ADI drafted the first manuscript with the supervision of JMMS. CLM analyzed the data. All authors contributed substantially to the interpretation of the data and the successive versions of the manuscript. All authors contributed to the manuscript and approved its final version. JMMS conceived the study and is the principal investigator of the project.

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