



Determinants of smoke-free homes adoption among Spanish adults who smoke: A prospective cohort study from the 2016–2021 International Tobacco Control (ITC) EUREST-PLUS Spain Surveys

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ABSTRACT

Objective: To assess the prevalence and associated factors of smoke-free homes (SFHs) among Spanish adults who smoke across three cohort waves, and to identify determinants of SFH adoption during follow-up (2016–2021). **Methods:** The International Tobacco Control EUREST-PLUS Spain Survey is a nationally representative cohort of ~1000 adults (≥18 years) who smoke surveyed in 2016, 2018, and 2021. First, we conducted repeated cross-sectional analysis to estimate the prevalence of SFHs at each wave. Second, we estimated incidence and risk ratios (RR) with 95 % confidence intervals (CI) for SFH adoption during the follow-up using adjusted generalised linear models. Independent variables included sociodemographics, smoking characteristics, and beliefs about second-hand smoke harms.

Results: SFH prevalence was 13.1 % in 2016, 19.0 % in 2018, and 31.5 % in 2021 (p trend <0.001). Quitting smoking (RR = 2.66; 95 % CI: 2.10, 3.36), remaining in any stage other than precontemplation (RR = 1.76; 1.13, 2.73) and progressing beyond precontemplation stage (RR = 2.59; 1.99, 3.37) were determinants of SFH adoption. Maintaining moderate or high nicotine dependence (RR = 0.46; 0.30, 0.69) was inversely associated with SFH adoption.

Conclusions: SFH prevalence among Spanish adults who smoke increased in 2016–2021. Initiatives promoting SFHs should encourage progression through the stages of change towards cessation and provide tailored support for individuals with high nicotine dependence.

1. Introduction

Spain ratified the World Health Organization Framework Convention on Tobacco Control in 2005 (WHO, 2025). Following this, Law 28/

2005 prohibited smoking in workplaces and certain public places, allowing some exceptions for hospitality venues (Ley 28/2005, 2005). In 2011, smoking bans were extended to all indoor areas of hospitality venues (Ley 42/2010, 2010).

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These legislative measures significantly reduced exposure to second-hand smoke (SHS) in public settings (*Grupo de Trabajo sobre Tabaquismo, 2017*). In 2009, SHS exposure among Spanish adults (aged ≥ 15) was 24.5 % at home and 29.9 % in transport and enclosed public places (*Instituto Nacional de Estadística, 2025*). After 2011 legislation, overall SHS exposure in enclosed public places decreased to 15.4 % in 2014 and 13.7 % in 2020 (*Instituto Nacional de Estadística, 2025*).

Nevertheless, SHS exposure continues to pose a significant burden in Spain. In 2020, SHS exposure was responsible for an estimated 2242 deaths in the population over age 35 (*Pérez-Ríos et al., 2023*). Currently, SHS exposure particularly continues to occur in homes in Spain. The overall SHS exposure at home among children (aged ≤ 12) increased from 25.7 % in 2016 to 29.8 % in 2019 (*Sanz-Mas et al., 2024*).

Voluntary household smoking rules play a critical role in reducing SHS exposure (*Semple et al., 2025*). In 2017–2018, 57.6 % of the Spanish general population reported living in a smoke-free home (SFH), defined as prohibiting smoking indoors. However, among individuals living with at least one person who smokes, SFH prevalence was remarkably lower, at 26.5 % (*Tigova et al., 2025*).

To address this public health problem and promote SFH adoption, particularly among people who smoke, monitoring SFH prevalence and its determinants is essential. While some national and European surveys provide cross-sectional insights (*Instituto Nacional de Estadística, 2025*; *Sanz-Mas et al., 2024*; *Tigova et al., 2025*; *Díez-Izquierdo et al., 2017*; *Arechavala et al., 2019*), longitudinal data enabling a deeper understanding of SFH adoption remain scarce in Spain. A cohort study among the general population in Barcelona, the second-largest city in Spain, with a population of about 1.7 million, showed that SFH prevalence increased from 23.9 % in 2003–2004 to 37.6 % in 2013–2014 (*Lidón-Moyano et al., 2016*). More recent longitudinal data, particularly among adults who smoke, are lacking.

The International Tobacco Control (ITC) Policy Evaluation EUREST-PLUS Spain Survey, a cohort of Spanish adults who smoke, established in 2016 and followed in 2018 and 2021, provides updated evidence on this issue (*Fu et al., 2023*; *Fu et al., 2019*). The study objective is twofold: 1) to assess SFH prevalence and the factors associated with having an SFH in each wave, and 2) to prospectively identify the determinants of SFH adoption over the follow-up period.

2. Methods

2.1. Study design and participants

This cohort study uses data from the three waves of the ITC EUREST-PLUS Spain Surveys. A nationally representative dynamic cohort of 1001 Spanish adults (aged ≥ 18) who smoke (smoked ≥ 100 cigarettes in their lifetime and smoked cigarettes at least monthly at recruitment) was established in 2016 (Wave 1) as part of the ITC EUREST-PLUS Project conducted in six European countries (*Vardavas et al., 2018*). Multistage sampling with geographical stratification was used, covering all Spanish regions, except the Canary Islands, Ceuta, and Melilla. Strata, defined by Nomenclature of Territorial Units for Statistics-2 regions and degree of urbanisation, were treated as a union of clusters where 100 clusters were sampled. Within each cluster 10 adults who smoke were recruited; households were selected using a random route approach with up to four contact attempts. Where possible, one male and one female person who smokes were randomly selected per household using the last birthday method (*Vardavas et al., 2018*; *ITC Project, 2017*).

In 2018 (Wave 2), a follow-up survey was conducted among 1008 respondents (294 new and 714 from Wave 1; 71.3 % retention rate). A second follow-up (Wave 3), conducted in 2021 (*Fu et al., 2023*), included 1006 adults (436 new and 570 from Wave 2; 56.7 % retention rate). The sample was replenished using the same methodology as in Wave 1, selecting new individuals from households within the original clusters (*Vardavas et al., 2018*; *ITC Project, 2017*; *ITC Project, 2022*; *ITC Project, 2019*; *Gravelly et al., 2020*).

For the first objective, we excluded respondents who did not answer the question on home smoking rules (one in Wave 1 and one in Wave 2). The resulting analytical samples were 1000 (Wave 1), 1007 (Wave 2), and 1006 (Wave 3). For the second objective, the analytical sample included 770 respondents who (1) participated in at least two waves, (2) provided data on home smoking rules, and (3) had the opportunity to adopt an SFH (i.e., were not living in an SFH at first wave considered); see Supplementary Table 2.

The study received ethical approval from the Research Ethics Boards of the Bellvitge University Hospital, Spain (PR100/16 and PR248/17) and the University of Waterloo, Canada (REB#41105). All participants provided informed consent. The study adhered to the institutions' guidelines for protection of human subjects concerning safety and privacy and is reported following the STROBE guideline (*von Elm et al., 2007*), Supplementary Table 1.

2.2. Measures

2.2.1. Outcome

The dependent variable was having an SFH, measured with the question: "Which of the following statements best describes smoking inside your home? I mean inside your house or dwelling and not on the balcony, terrace, or other outdoor areas." The response options were: 1) Smoking is allowed anywhere; 2) Smoking is allowed in some rooms; 3) Smoking is never allowed anywhere; 4) Smoking is not allowed except under special circumstances. For the cross-sectional analyses, respondents were classified as 1) having a complete home smoking restriction (i.e., SFH; response 3), 2) having a partial restriction (responses 2, 4), and 3) not having restrictions (response 1). For the longitudinal analysis, having an SFH was treated as binary variable: yes (response 3) or no (responses 1–2, 4).

2.2.2. Exposure

All Wave 1 respondents smoked daily or non-daily. For Waves 2 and 3, smoking status was categorised as smoking 1) daily, 2) non-daily, 3) formerly. For the longitudinal analysis, we assessed changes in smoking status at the first and last surveys considered, categorised as 1) maintained: no change; 2) increased: shift from former/non-daily to daily smoking; 3) decreased: change from daily to non-daily smoking; 4) quit.

Among those smoking daily, nicotine dependence was assessed using the Heaviness of Smoking Index calculated from the number of cigarettes smoked per day (1–10, 11–20, 21–30, >30) and the time to the first cigarette after waking (>60 , 31–60, 6–30, ≤ 5 min). Each item was scored 0–3, resulting in a total score 0–6, categorised as low (0–1), moderate (2–4), or high (5–6) (*Heatherton et al., 2025*). For the longitudinal analysis, variations in the dependence level were categorised as: 1) low maintained; 2) moderate or high maintained; 3) increased: change from low to moderate or low/moderate to high; 4) decreased: change from high to moderate or high/moderate to low; 5) former smoking: quitting or maintaining abstinence.

Quit attempts in the last 12 months were classified as a binary variable (yes/no).

The stage of change towards cessation variable was constructed from several questions and categorised as 1) precontemplation: not intending to quit, or intending beyond six months; 2) contemplation: intending to quit within 1–6 months or within the next month but with a prior intent in the past year that lasted less than a day; 3) preparation: intending to quit within a month, with a past-year quit attempt lasting more than one day; 4) action: quit within the past six months; 5) maintenance: quit more than six months ago (*DiClemente et al., 1991*). For the longitudinal analysis, transitions in the stage of change were categorised as: 1) precontemplation stage maintained; 2) any other than precontemplation stage maintained; 3) progress from precontemplation to a more advanced stage; 4) regression from any stage to precontemplation.

Respondents were also asked "Based on what you know or believe, does breathing SHS cause... 1) lung cancer in non-smokers, 2) heart

attack in non-smokers, 3) asthma in children". Responses were binary (yes/no). An additional question was asked: "SHS is dangerous to non-smokers" with response options: "strongly agree", "agree", "neither agree nor disagree", "disagree", or "strongly disagree", recoded as: "agree" (responses 1–2) and "otherwise" (responses 3–5).

We obtained data on whether respondents were living with children aged <18 (yes/no) and had significant others who smoked: 1) a partner (regardless of having friends who smoke), 2) friends but not a partner, 3) none.

2.2.3. Covariates

We measured the respondents' sex (male, female), age (18–39, 40–54, ≥55 years), and educational level (low: up to lower secondary; medium: upper secondary to short-cycle tertiary; high: completed university education). The number of missing values excluded from the analyses is presented in Supplementary Table 3.

2.3. Statistical analyses

First, a repeated cross-sectional analysis was conducted to estimate the weighted relative prevalence and 95 % confidence intervals (CI) of different home smoking restrictions in each wave. We described the characteristics of respondents reporting an SFH using unweighted frequencies, weighted prevalence, and chi-squared tests. Second, the longitudinal analysis estimated the incidence and risk ratios (RR) with 95 % CI for SFH adoption using generalised linear models with a Poisson family, adjusted for age, sex, educational level, smoking status, wave of the event (SFH adoption), and waves in cohort (1–2, 2–3, or 1–3). All inferential analyses applied either cross-sectional or longitudinal weighting to ensure national representativeness. Analyses were conducted using Stata® v.14 (Texas, USA).

3. Results

Most respondents were male, 18–54 years old, with low or moderate educational level, and lived without children. The majority smoked daily, reported low or moderate nicotine dependence, and had made quit attempts in the past year (see Supplementary Table 4 for more details on samples characteristics). Among Spanish adults who smoke, 13.1 % (11.9 % among men and 14.8 % among women; $p = 0.085$) had

an SFH in 2016, which increased to 19.0 % (20.6 % and 17.2 %, respectively; $p = 0.176$) in 2018 and to 31.5 % (33.3 % and 29.7 %, respectively; $p = 0.242$) in 2021 (p for trend <0.001; Fig. 1 and Table 1). In 2016, SFH prevalence was the highest among younger respondents (14.9 % aged 18–39, 11.6 % aged 40–54, and 12.5 % aged ≥55; $p = 0.347$). In 2018, the highest prevalence was among middle-aged respondents (18.2 %, 20.3 %, and 18.4 %, respectively; $p = 0.759$), while in 2021, it was highest among those aged ≥55 (27.4 %, 32.7 %, and 34.3 %, respectively; $p = 0.116$; Table 1).

The prevalence of homes with no smoking restrictions declined from 45.6 % in 2016 to 38.3 % in 2018, and 26.5 % in 2021 (p for trend <0.001). The prevalence of partial restrictions remained stable, ranging from 41.3 % to 42.7 % (p for trend = 0.598; Fig. 1).

Characteristics that were significantly associated with having an SFH across all waves included not having significant others who smoke, non-daily or former smoking, having low nicotine dependence, and being in the maintenance, action, or preparation stages of change (Table 1). Regarding beliefs about SHS harms, no consistent associations were observed.

The longitudinal analysis showed that the incidence of SFH adoption was 29.3 % (Table 2). Participation in Waves 1–2 and 2–3, compared to participation in Waves 1–3, and SFH adoption at Wave 2 were significant variables in the model (not shown in the table).

Only smoking-related characteristics were significantly associated with SFH adoption during the study period (Table 2). When analysing changes in the respondents' smoking status between waves, quitting was a significant factor (RR = 2.66; 95 % CI: 2.10, 3.36), compared to maintaining the same smoking status. Remaining in any stage of change other than precontemplation (RR = 1.76; 95 % CI: 1.13, 2.73) and progressing from precontemplation to a more advanced stage (RR = 2.59; 95 % CI: 1.99, 3.37) were significantly associated with SFH adoption, compared to remaining in precontemplation stage. In contrast, maintaining a moderate or high nicotine dependence (RR = 0.46; 95 % CI: 0.30, 0.69) was inversely associated with SFH adoption compared to consistent reporting of low dependence (Table 2).

4. Discussion

The prevalence of SFHs among Spanish adults who smoke increased steadily from 13 % in 2016 to 32 % in 2021. Factors significantly

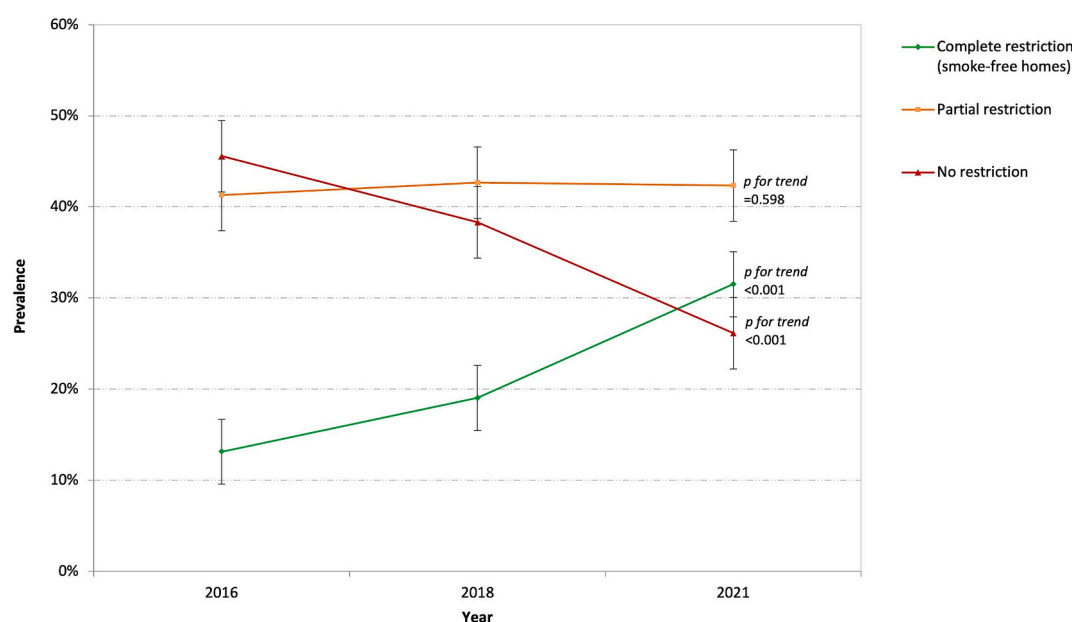


Fig. 1. Prevalence and 95 % confidence intervals of home smoking restrictions among a cohort of Spanish adults who smoke or quit recently. International Tobacco Control EUREST-PLUS Spain Surveys, 2016 ($N = 1000$), 2018 ($N = 1007$), 2021 ($N = 1006$).

Table 1

Characteristics of Spanish adults who smoke and report having a smoke-free home in the three waves of the International Tobacco Control EUREST-PLUS Spain Surveys (2016, 2018, and 2021).

Characteristics	Year (sample size)								
	2016 (N = 1000)			2018 (N = 1007)			2021 (N = 1006)		
	n	% ¹	p-value ²	n	% ¹	p-value ²	n	% ¹	p-value ²
Total	147	13.1		207	19.0		311	31.5	
Sociodemographics									
Sex			0.085			0.176			0.242
Male	77	11.9		125	20.6		184	33.3	
Female	70	14.8		82	17.2		127	29.7	
Age, years			0.347			0.759			0.116
18–39	71	14.9		74	18.2		88	27.4	
40–54	43	11.6		81	20.3		121	32.7	
≥55	33	12.5		52	18.4		102	34.3	
Educational level			0.009			0.232			0.370
Low	51	9.6		54	15.7		143	29.4	
Moderate	86	16.8		132	20.2		136	34.6	
High	10	11.1		21	21.6		32	30.8	
Children under 18 years at home			0.020			0.095			0.006
Yes	59	16.9		72	22.2		127	38.9	
No	88	11.1		135	17.8		184	28.0	
Significant others who smoke			0.006			0.006			0.001
Partner	32	8.3		41	14.9		70	25.1	
Friends but not partner	104	15.2		138	19.5		194	32.1	
None	11	20.6		28	32.9		47	48.4	
Smoking-related characteristics									
Smoking status			<0.001			<0.001			<0.001
Daily	134	12.2		147	16.0		214	25.8	
Non-daily	13	45.1		11	31.2		16	37.3	
Former	–			49	40.0		81	60.5	
Nicotine dependence ³			<0.001			<0.001			0.002
Low	67	18.5		74	23.9		94	34.7	
Moderate	64	9.9		70	12.2		113	21.4	
High	3	3.4		3	6.3		7	20.1	
Quit attempts			<0.001			0.129			0.302
Yes	37	20.6		58	22.1		45	35.4	
No	110	11.5		149	18.1		266	30.9	
Stage of change			0.004			<0.001			<0.001
Maintenance ⁴	–	–		33	45.4		72	63.2	
Action ⁴	–	–		16	31.9		9	43.5	
Preparation	7	36.9		5	27.4		6	39.9	
Contemplation	20	17.2		32	26.6		27	31.0	
Precontemplation	117	12.2		120	15.0		193	25.5	
Psychological beliefs on the effects of SHS to people who do not smoke									
SHS causes lung cancer			0.376			0.025			0.013
Yes	94	12.2		151	16.7		246	34.8	
No	52	14.9		56	28.0		65	24.0	
SHS causes heart attack			0.540			0.074			0.774
Yes	72	12.3		132	16.7		175	31.0	
No	75	14.0		74	24.2		136	32.2	
SHS causes asthma in children			0.005			0.039			0.573
Yes	113	15.5		148	17.0		214	30.8	
No	34	8.0		59	26.7		97	33.4	
SHS is dangerous to people who do not smoke			0.011			0.113			0.001
Agree	134	14.2		176	19.9		276	34.1	
Otherwise	13	6.9		30	14.7		31	17.7	

SHS: second-hand tobacco smoke.

¹ Weighted estimates.

² Chi-squared test. Statistical significance was set as alpha = 0.05.

³ Among those who smoke daily.

⁴ No estimates for 2016 (Wave 1) as only people who currently smoked were recruited and therefore no one was at the action or maintenance stages of change.

associated with having an SFH across all waves included not having significant others who smoke, smoking non-daily or formerly, having low nicotine dependence, and being at an advanced stage of change towards cessation. Determinants of SFH adoption over the follow-up were quitting smoking, maintaining low nicotine dependence, and either progressing beyond the precontemplation stage or remaining in a more advanced stage of change.

The increasing prevalence of SFHs among Spanish adults who smoke continues the growth observed in Barcelona between 2003 and 2014 (Lidón-Moyano et al., 2016). The prevalence in our study is slightly lower than in other national surveys: 26.0 % in 2016 (Diez-Izquierdo

et al., 2017), and 25.0 % in 2017–2018 (Tigova et al., 2025), though comparisons are limited by their small subsamples of individuals who smoke.

This upward trend in Spain aligns with other national ITC surveys. European ITC surveys reported increases in SFH prevalence in Ireland (17.0 %–21.3 %), France (24.1 %–28.2 %), Germany (29.7 %–40.9 %), the Netherlands (14.6 %–18.7 %), and the United Kingdom (UK) (24.0 %–29.3 %) in the mid-2000s (Mons et al., 2013). Similarly, ITC surveys in Australia, Canada, the United States (US), and the UK have showed gradual increases since 2002, reaching 66.2 %, 67.8 %, 60.3 %, and 59.2 % by 2016, respectively (Nahhas et al., 2019; Borland et al., 2006). At

Table 2

Factors associated with adoption of smoke-free homes by Spanish adults who smoke (International Tobacco Control EUREST-PLUS Spain Surveys, 2016–2021).

Characteristics	Total N	Events (n) ¹	Incidence (%) ²	RR ³	95 % CI
Total	770	238	29.3		
Sociodemographics					
Sex					
Male	413	142	31.2	1.11	0.86, 1.42
Female	357	96	26.8	1.00	
Age, years					
18–39	291	90	29.7	1.00	
40–54	280	80	26.0	0.85	0.63, 1.15
≥55	199	68	35.1	1.19	0.86, 1.65
Educational level ⁵					
Low	322	96	29.4	1.11	0.70, 1.75
Moderate	388	127	29.6	1.15	0.73, 1.80
High	59	15	27.0	1.00	
Children under 18 years at home					
Yes	253	78	28.5	1.15	0.87, 1.53
No	517	160	29.7	1.00	
Significant others who smoke ⁵					
Partner	270	73	26.7	1.00	
Friends but not partner	457	148	30.0	0.96	0.73, 1.27
None	41	16	40.3	1.05	0.65, 1.68
Smoking-related characteristics					
Change in smoking status					
Maintained	595	136	21.2	1.00	
Increased	6	2	33.3	1.24	0.31, 4.93
Decreased	12	4	24.5	1.01	0.43, 2.36
Quit	157	96	62.7	2.66	2.10, 3.36
Change in nicotine dependence ^{4,5}					
Low maintained	108	39	33.0	1.00	
Moderate or high maintained	325	51	14.5	0.46	0.30, 0.69
Increased	72	17	17.6	0.56	0.31, 1.01
Decreased	79	26	35.2	1.07	0.68, 1.68
Former smoking	162	97	60.8	1.71	1.22, 2.38
Quit attempts at any wave					
Yes	307	105	33.3	1.16	0.91, 1.48
No	463	133	26.8	1.00	
Change in stage of change ⁵					
Precontemplation stage maintained	459	98	19.4	1.00	
Any other than precontemplation stage maintained	53	20	37.3	1.76	1.13, 2.73
Progress from precontemplation to a more advanced stage	177	96	55.3	2.59	1.99, 3.37
Regressions from any stage to precontemplation	53	16	29.0	1.40	0.88, 2.23
Psychological beliefs on the effects of SHS to people who do not smoke					
SHS causes lung cancer					
Yes (at any wave)	722	224	29.4	0.92	0.53, 1.57
No	48	14	27.4	1.00	
SHS causes heart attack					
Yes (at any wave)	663	205	29.4	0.92	0.65, 1.31
No	107	33	28.8	1.00	
SHS causes asthma in children					
Yes (at any wave)	723	226	29.5	1.03	0.56, 1.90
No	47	12	25.5	1.00	
SHS is dangerous					
Agree (at any wave)	743	229	29.2	0.79	0.42, 1.49
Otherwise	27	9	34.8	1.00	

CI: confidence interval; SHS: second-hand tobacco smoke.

¹ Absolute (unweighted) number of respondents who adopted a smoke-free home in the study follow-ups.² Weighted unadjusted estimates.³ Risk ratios and 95 % confidence intervals were estimated using generalised linear models with a Poisson family adjusted for age, sex, educational status, smoking status, wave of event (SFH adoption) and waves in cohort.⁴ Among those who smoke daily.⁵ Missing values: 1 for educational level, 2 for significant others who smoke, 24 for change in level of nicotine dependence, 28 for change in stage of change regarding smoking cessation.

that time, SFH prevalence in Spain was roughly four times lower, reaching only about half these levels by 2021.

These differences may reflect cultural norms, particularly higher social acceptance of smoking in Spain (Passey et al., 2016). A 2016 ITC study found that, compared to the UK, Spanish adults who smoke reported having more close friends who smoked, perceived greater approval of smoking from significant others and the public, and were less inclined to view people who smoke as marginalised (East et al., 2019). Another factor may be the implementation of public health campaigns promoting SFH adoption in those countries (Turner et al.,

2020; McCarthy, 2001; Lim et al., 2024). A recent systematic review found that several such campaigns had a positive impact on SFH adoption (Lim et al., 2024). In Spain, a few SHS campaigns have been conducted, but none specifically on SFHs (Lim et al., 2024; Ministerio de Sanidad, 2025). Future efforts should therefore consider larger campaigns focused on promoting SFHs.

The smoking social environment was a significant correlate of having an SFH. This is consistent with the 2016 ITC data from six European countries (Fu et al., 2019), and from Australia, Canada, the UK, and the US (Nahhas et al., 2019), which showed that individuals living with a

partner who smoked had approximately 50 % higher odds of not having an SFH. A body of literature has examined how the social influence of others, and their smoking behaviours, may encourage or hinder the adoption of SFHs (Passey et al., 2016). This highlights that SFH promotion strategies may be more effective if they address the social environment and support individuals in managing pressure from partners, family members or peers who smoke.

Respondents who smoked non-daily had higher rates of SFH compared to those who smoked daily. This finding is consistent with the 2016 data from Australia, Canada, the UK, and the US, where SFH prevalence was more than twice as high among those who smoked daily (Nahhas et al., 2019). Non-daily smoking often reflects lower addiction, a commonly perceived barrier to establishing or maintaining an SFH (Passey et al., 2016). Non-daily smoking may facilitate better craving control (Shiffman et al., 2015). Some respondents smoking non-daily may follow social smoking patterns, typically occurring outside the home (Schane et al., 2009). Although few smoked non-daily, less than half of them had an SFH at the last follow-up, emphasising the need for interventions tailored for this group.

Reporting former smoking status at Waves 2 and 3 was associated with having an SFH, and both quitting and sustained abstinence were significant determinants of SFH adoption. Previous cross-sectional and longitudinal studies have consistently identified smoking cessation as a predictor of SFH (Tigova et al., 2025; Lidón-Moyano et al., 2016; Nahhas et al., 2019). Current evidence supports both pathways regarding cessation and SFH adoption which are not contradictory: on one hand, SFH adoption facilitates smoking cessation; on the other, it may be a consequence of it (Borland et al., 2006; Haardörfer et al., 2018). Our findings support the notion that quitting smoking contributes to SFH adoption. Also, over one-third of those who quit did not implement an SFH. Thus, quitting smoking does not always lead to SFH adoption, as other factors such as the smoking behaviour of other household members or social pressure may also influence it (Passey et al., 2016; Escoffery et al., 2009). Therefore, future interventions should also target individuals who have quit smoking, and SFH promotion initiatives could be integrated into all stages of cessation support, including post-cessation follow-up. Moreover, future research using mixed methods or qualitative approaches may be warranted to further explore cessation and its role in SFH adoption in Spain.

Consistently with previous research (Fu et al., 2019; Mons et al., 2013; Borland et al., 2006), low nicotine dependence was associated with having an SFH, whereas maintaining moderate or high dependence was linked to lower SFH adoption. A systematic review reported that high nicotine dependence is an important barrier in establishing an SFH, it can impair rational decision-making, preventing individuals from implementing SFHs despite awareness of risks and intentions to avoid smoking at home (Passey et al., 2016). Additionally, some people who smoke consider quitting as a prerequisite for an SFH, perceiving their inability to quit as an impediment (Passey et al., 2016).

Finally, being at an advanced stage of change towards cessation was a significant factor of having an SFH. Remaining at an advanced stage or progressing from the precontemplation stage predicted SFH adoption. Similar to other smoking-related determinants discussed, greater preparedness to quit and making steps towards cessation increase the likelihood of SFH adoption, both as an intermediate step towards quitting and due to increased motivation and perceived benefits of cessation (DiClemente et al., 1991; Passey et al., 2016). Therefore, individuals' stage of change is a key leverage point for intervention, and stage-specific components should be incorporated into SFH promoting initiatives (Escoffery et al., 2009).

This study has some limitations. Not all respondents recruited at Wave 1 were followed up through Wave 3; therefore, attrition might have influenced the findings. Additionally, reliance on self-reported data poses a risk of information bias. Also, we focused on progressing from a non-SFH to an SFH; future research could also explore the determinants of regression to inform interventions promoting maintenance of adopted

SFHs. Finally, while we used a standardised questionnaire (Fu et al., 2023), results may not be comparable to those from studies using different instruments.

However, this is the first longitudinal study to explore trends and determinants of SFH adoption among Spanish adults who smoke. We employed a rigorous design and sampling procedures (ITC Project, 2022), enabling generalisation to Spanish adults who smoke. Finally, the standardised questionnaire enables for comparisons with other ITC studies.

5. Conclusion

This first longitudinal study among Spanish adults who smoke identified an overall increasing trend in SFH prevalence from 2016, reaching 32 % in 2021. SFH adoption was associated with a non-smoking social environment and smoking-related characteristics including non-daily or former smoking, low nicotine dependence, and being at or progressing to a more advanced stages of change. Therefore, initiatives to support this increasing trend and promote SFHs in Spain should: 1) address social smoking environments, 2) support cessation to encourage SFH adoption, 3) target individuals who smoke non-daily and those who have quit smoking, 4) promote progression through the stages of change towards cessation, and 5) offer tailored support for individuals with high nicotine dependence.

CRedit authorship contribution statement

Olena Tigova: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Conceptualization. **Yolanda Castellano:** Writing – review & editing, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Marcela Fu:** Writing – review & editing, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Pete Driezen:** Writing – review & editing, Validation, Methodology, Data curation. **Cristina Martínez:** Writing – review & editing, Supervision, Conceptualization. **Anne C.K. Quah:** Writing – review & editing, Resources, Project administration, Methodology, Investigation, Conceptualization. **Geoffrey T. Fong:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Esteve Fernández:** Writing – review & editing, Supervision, Resources, Methodology, Investigation, Funding acquisition, Conceptualization.

Disclaimer

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2025.108415>.

Data availability

In each country participating in the International Tobacco Control Policy Evaluation (ITC) Project, the data are jointly owned by the lead researcher(s) in that country and the ITC Project at the University of Waterloo. Data from the ITC Project are available to approved researchers two years after the date of issuance of cleaned data sets by the ITC Data Management Centre. Researchers interested in using ITC data are required to apply for approval by submitting an International Tobacco Control Data Repository (ITCDR) request application and subsequently to sign an ITCDR Data Usage Agreement. The criteria for data usage approval and the contents of the Data Usage Agreement are described online (<http://www.itcproject.org>).

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