

# SMOKE-FREE HOMES IN POLAND DURING THE COVID-19 PANDEMIC – A NATIONWIDE CROSS-SECTIONAL SURVEY

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## Abstract

**Objectives:** Secondhand smoke exposure causes serious health problems. Banning smoking in public venues decreases exposure to secondhand smoke. However, the implementation of smoke-free rules in a private setting (including homes) is largely voluntary. This study aimed to assess the prevalence and characteristics of voluntary smoke-free home rules in Poland during the COVID-19 pandemic as well as to identify factors associated with the voluntary implementation of smoking bans at home. **Material and Methods:** This cross-sectional survey was conducted in March 2022 with a nationally representative sample of 1090 individuals aged  $\geq 18$  years in Poland. Data were collected using a computer-assisted web interviewing (CAWI) technique. The research tool was an original questionnaire developed for the purpose of this study. **Results:** Nationally, 60.6% of individuals had total ban on smoking in home (100% smoke-free home rules), 34.0% had implemented a partial smoke-free home rule and 5.4% had not implemented any smoke-free home rules. Over three-quarters of non-smokers (76.8%) and only one-fifth of smokers (20.7%) had adopted a full smoke-free home rule. In multivariate logistic regression analysis, males (OR = 1.65, 95% CI: 1.22–2.22,  $p < 0.01$ ), non-smokers (OR = 13.78, 95% CI: 9.80–19.38,  $p < 0.001$ ), respondents who had higher education (OR = 1.57, 95% CI: 1.15–2.14,  $p < 0.01$ ) as well as those who lived alone (OR = 2.44, 95% CI: 1.52–3.90,  $p < 0.001$ ) had higher odds of having a 100% smoke-free home rule. **Conclusions:** This study demonstrated the negative impact of the COVID-19 pandemic on the implementation of smoke-free home rules in Poland. Less than two-thirds of the Polish population has adopted a total smoke-free home rule, with significant gaps between smokers and nonsmokers. Information on current voluntary smoke-free rules will be useful for further implementation of the smoke-free law in Poland. *Int J Occup Med Environ Health.* 2023;36(1):84–95

## Key words:

Poland, secondhand smoke, smoking ban, passive smoking, tobacco control, smoke-free policy

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## INTRODUCTION

Secondhand smoke (SHS) is a mixture of side-stream smoke from burning tobacco products, and the smoke exhaled by smokers [1–3]. It contains >7000 chemicals, of which hundreds are toxic and >50 are carcinogenic [2,3]. Secondhand smoke exposure causes cardiovascular disease (e.g., myocardial infarction or stroke), lung cancer, exacerbation of asthma, respiratory infections, ear infections, and other serious health problems [2–4]. Every year, secondhand smoke exposure causes >1.2 million SHS-related deaths globally [5].

In 2016, approximately one-fifth of males and one-third of females globally were exposed to SHS [6]. Secondhand smoke exposure usually occurs indoors (e.g., in the workplace, home, car) [5,7]. As SHS can move between indoor areas (e.g., rooms), opening a window or ventilation in a home or car does not provide complete protection against SHS exposure [8]. According to the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC), there is no risk-free level of the SHS [1,5]. The implementation of total ban on smoking is the most effective way to reduce SHS exposure in public and private venues [1–3,9].

World Health Organization has developed a set of tobacco control measures to help member states ensure a smoke-free environment [10]. Strengthened smoke-free legislation is also one of the priorities of the European Union's (EU) health policy. In 2009, the EU called on member states to adopt and implement comprehensive smoke-free policies. By 2012, all 34 countries within the WHO European Region had at least some laws prohibiting smoking in public venues [11].

Public policies to reduce SHS exposure mostly focus on work and public places. Many countries have banned smoking in selected public venues [12]. However, the implementation of smoke-free rules in a private setting such as home is mostly voluntary. Implementation of smoke-free home rules may drive changes in smoking behavior (e.g., prevent smoking initiation in children and decrease nicotine dependence in adults) [13].

After the democratic changes in 1989, Poland has made substantial progress in tobacco control [14]. In 1995, Poland passed the first anti-tobacco law. In 2010, the smoke-free law was significantly expanded [14]. Between 2009 and 2011, a markable decrease in SHS exposure (general population) was observed in all public places [14]. Within a decade of the amendment of the Tobacco Control Act, the percentage of Poles exposed to SHS in transport services decreased fourfold [14]. Between 2009–2010 and 2019, the prevalence of total smoke-free home rules in Poland increased from 37.1% [15] to 66.1% [16].

The COVID-19 pandemic has a significant impact on lifestyle, including diet, physical exercise, social relationships, and smoking habits [17,18]. It is estimated that up to 8 million Poles worked remotely during the COVID-19 pandemic [19]. Anti-epidemic measures, including lockdowns and remote work, may have a significant impact on secondhand smoke exposure. Children staying at home with their smoking parents may be particularly vulnerable to SHS exposure. However, data on smoking behaviors and smoke-free policies during the COVID-19 pandemic are very limited [20,21].

Therefore, this study aimed to assess the prevalence of voluntary smoke-free home rules in Poland during the COVID-19 pandemic and to identify factors associated with the voluntary implementation of smoking ban in home.

## MATERIAL AND METHODS

### Participants

This cross-sectional survey was carried out in March 2022 on a representative sample of 1090 adults in Poland using a computer-assisted web interviewing (CAWI) technique. Data were collected by a specialized public opinion research company (Nationwide Research Panel Ariadna) on behalf of the authors, which provided the scientific content of this study. Data were collected using an online research platform – a dedicated IT system developed and managed by the public opinion research company [22].

Respondents were selected from the dataset of >110 000 registered and verified individual users of the public opinion research company [22]. A non-probability quota sampling was applied [22]. The following demographic variables were included in the stratification model: age, gender, place of residence (size of domicile and territorial distribution within voivodeships). Demographic data used for sampling were obtained from population reports published by the Polish Central Statistical Office, Warsaw, Poland [23].

Participation in this study was voluntary and anonymous. Informed consent was collected from all the participants. The study protocol was reviewed and approved by the Institutional Review Board at the Centre of Postgraduate Medical Education, Warsaw, Poland (approval No. 21/2022 as of 16 Feb 2022).

### Measures

This study was carried out as a part of the scientific project entitled “Poles’ attitudes towards smoking,” which is carried out regularly by the School of Public Health, Centre of Medical Postgraduate Education [14,16]. The study questionnaire included 12 closed questions addressed in the same way as in the previous wave of the study (2019) to ensure comparability of data between individual years [14,24]. Questions addressed smoking status (current tobacco use), smoke-free rules in the home (total ban – “100% smoke-free home”; partial ban – “smoking allowed in designated areas”; no ban – “smoking in the home allowed without limitations”) as well as sociodemographic characteristics. A detailed description of the study questionnaire was presented in a previously published paper [24]. In this study, participants were classified into 2 groups: total ban or no total ban (partial ban or no rules) on smoking in the home.

### Statistical analysis

Data were analyzed with IBM SPSS v. 27. Descriptive statistics (frequencies and proportions) were used to present

the distribution of categorical variables. Chi-square test was performed to compare categorical variables.

Associations between socio-demographic characteristics (age, gender, educational level, marital status, financial situation, occupational status, having children, household size, living with underage children, having children) and smoking status with the implementation of total ban on smoking in home were conducted using logistic regression analyses.

In the model, voluntary implementation of a total smoking ban at home was considered as a dependent variable. The socio-demographic characteristics and smoking status were considered as independent variables. In univariate logistic regression analyses, all variables were considered separately. The multiple logistic regression analyses included all the variables, that were significantly associated with total ban on smoking in home in any of the univariate models. The strength of association was measured by the odds ratio (OR) and 95% confidence intervals (CI). The level of statistical significance was based on the criterion  $p < 0.05$ .

## RESULTS

### Study population

Completed questionnaires were obtained from 1090 individuals aged  $45.2 \pm 16.2$  years, 52.6% females. Most of the participants were occupationally active (60.5%), 14.8% lived alone and 31.8% had children in home. Among the respondents, 28.8% were smokers (Table 1).

### Smoke-free home rules

Nationally, 60.6% of individuals had total ban on smoking in home (100% smoke-free rule), 34.0% had implemented a partial ban on smoking in home and 5.4% had not implemented ban on smoking in home (Table 2).

Males significantly more often declared the implementation of total ban on smoking in home than females (64.0% vs. 57.6%,  $p = 0.03$ ). Out of all respondents, those who had

**Table 1.** Characteristics of the study population, nationwide cross-sectional survey, March 4–7, 2022, Poland

Variable	Participants (N = 1090)	
	n	%
Gender		
male	517	47.4
female	573	52.6
Age		
18–29 years	222	20.3
30–39 years	231	21.2
40–49 years	186	17.1
50–59 years	196	18.0
≥60 years	255	23.4
Marital status		
ever married	682	62.6
never married	408	37.4
Occupational status		
active	659	60.5
passive	431	39.5
Self-reported financial status		
good	455	41.7
moderate	424	38.9
bad	211	19.4
Having higher education		
yes	450	41.3
no	640	58.7
Household members		
1 (living alone)	161	14.8
≥2	929	85.2
Having children		
yes	707	64.9
no	383	35.1
Children (<18 years old) in home		
yes	347	31.8
no	743	68.2
Place of residence		
rural	339	31.1

Variable	Participants (N = 1090)	
	n	%
city		
<20 000 residents	138	12.7
20 000–99 999 residents	253	23.2
100 000–499 999 residents	211	19.4
≥500 000 residents	149	13.7
Smoking status		
smoker	314	28.8
non-smoker	776	71.2

higher education (70.2% vs. 53.9%,  $p < 0.001$ ) as well as those who lived alone (73.9% vs. 58.3%,  $p < 0.001$ ) more often declared the implementation of total ban on smoking in home (Table 2). Moreover, those respondents who do not have a child (65.8% vs. 57.9%,  $p = 0.01$ ) more often declared the implementation of total ban on smoking in home.

Among smokers, males compared to females more often declared the implementation of total ban on smoking in home (25.2% vs. 16.1%,  $p = 0.04$ ). The percentage of smokers who implemented total ban has decreased with the age (Table 2). Moreover, smokers who do not have a child more often declared the implementation of total ban on smoking in home (28.9% vs. 17.4%,  $p = 0.02$ ).

Among non-smokers, males compared to females more often declared implementation of total ban on smoking in home (81.3% vs. 73.0%,  $p = 0.01$ ). Moreover, non-smokers who had higher education (82.6% vs. 72.0%,  $p < 0.001$ ) as well as those who lived alone (92.4% vs. 74.0%,  $p < 0.001$ ) more often declared implementation of total ban on smoking in home (Table 2).

### Factors associated with implementation of total ban on smoking in home

In multivariate logistic regression analysis (Table 3), males (OR = 1.65, 95% CI: 1.22–2.22,  $p < 0.01$ ), non-smokers (OR = 13.78, 95% CI: 9.80–19.38,  $p < 0.001$ ), respondents

**Table 2.** Proportion of participants with smoke-free home rules by smoking status, nationwide cross-sectional survey, March 4–7, 2022, Poland

Variable	Participants (N = 1090) [n (%)]						p
	total		smokers (N = 314)		non-smokers (N = 776)		
	total ban (N = 661, 60.6%)	no total ban (N = 429, 39.4%)	total ban (N = 65, 20.7%)	no total ban (N = 249, 79.3%)	total ban (N = 596, 76.8%)	no total ban (N = 180, 23.2%)	
Gender							
male	331 (64.0)	186 (36.0)	40 (25.2)	119 (74.8)	305 (73.0)	113 (27.0)	0.01
female	330 (57.6)	243 (42.4)	25 (16.1)	130 (83.9)	291 (81.3)	67 (18.7)	
Age							
18–29 years	138 (62.2)	84 (37.8)	20 (33.9)	39 (66.1)	118 (72.4)	45 (27.6)	0.3
30–39 years	147 (63.6)	84 (36.4)	18 (26.1)	51 (73.9)	129 (79.6)	33 (20.4)	
40–49 years	101 (54.3)	85 (45.7)	12 (18.8)	52 (81.3)	89 (73.0)	33 (27.0)	
50–59 years	111 (56.6)	85 (43.4)	6 (9.7)	56 (90.3)	105 (78.4)	29 (21.6)	
≥60 years	164 (64.3)	91 (35.7)	9 (15.0)	51 (85.0)	155 (79.5)	40 (20.5)	
Marital status							
ever married	415 (60.9)	267 (39.1)	40 (20.3)	157 (79.7)	375 (77.3)	110 (22.7)	0.7
never married	246 (60.3)	162 (39.7)	25 (21.4)	92 (78.6)	221 (75.9)	70 (24.1)	
Occupational status							
active	394 (59.8)	265 (40.2)	44 (21.0)	166 (79.0)	350 (78.0)	99 (22.0)	0.5
passive	267 (61.9)	164 (38.1)	21 (20.2)	83 (79.8)	246 (75.2)	81 (24.8)	
Self-reported financial status							
good	289 (63.5)	166 (36.5)	27 (20.6)	104 (79.4)	262 (80.9)	62 (19.1)	0.06
moderate	253 (59.7)	171 (40.3)	25 (22.5)	86 (77.5)	228 (72.8)	85 (27.2)	
bad	119 (56.4)	92 (43.6)	13 (18.1)	59 (81.9)	106 (76.3)	33 (23.7)	
Having higher education							
yes	316 (70.2)	134 (29.8)	26 (26.3)	73 (73.7)	290 (82.6)	61 (17.4)	<0.001
no	345 (53.9)	295 (46.1)	39 (18.1)	176 (81.9)	306 (72.0)	119 (28.0)	



**Table 3.** Factors associated with voluntary implementation of total ban on smoking in home, nationwide cross-sectional survey, March 4–7, 2022, Poland

Variable	Logistic regression (OR (95% CI))	
	univariate	multivariate
Gender		
female (ref.)		
male	1.31 (1.03–1.67)*	1.65 (1.22–2.22)**
Smoking status		
smoker (ref.)		
non-smoker	12.7 (9.21–17.47)***	13.78 (9.80–19.38)***
Age		
18–29 years	0.91 (0.63–1.32)	0.78 (0.44–1.38)
30–39 years	0.97 (0.67–1.41)	1.33 (0.84–2.12)
40–49 years	0.66 (0.45–0.97)*	1.26 (0.79–2.00)
50–59 years	0.73 (0.50–1.06)	0.75 (0.49–1.13)
≥60 years (ref.)		
Marital status		
ever married	1.02 (0.80–1.32)	
never married (ref.)		
Occupational status		
active (ref.)		
passive	1.10 (0.85–1.41)	
Self-reported financial status		
good	1.35 (0.97–1.88)	
moderate	1.14 (0.82–1.60)	
bad (ref.)		
Having higher education		
yes	2.02 (1.56–2.60)***	1.57 (1.15–2.14)**
no (ref.)		
Household members		
1 (living alone)	2.02 (1.39–2.94)***	2.44 (1.52–3.90)***
≥2 (ref.)		
Having children		
yes	0.71 (0.55–0.92)**	0.97 (0.65–1.43)
no (ref.)		
Children (<18 years old) in home		
yes	0.79 (0.61–1.02)	
no (ref.)		

**Table 3.** Factors associated with voluntary implementation of total ban on smoking in home, nationwide cross-sectional survey, March 4–7, 2022, Poland – cont.

Variable	Logistic regression (OR (95% CI))	
	univariate	multivariate
Place of residence		
rural	1.03 (0.69–1.52)	
city		
<20 000 residents	1.12 (0.70–1.81)	
20 000–99 999 residents	0.82 (0.54–1.23)	
100 000–499 999 residents	1.04 (0.68–1.61)	
≥500 000 residents (ref.)		

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

with higher education (OR = 1.57, 95% CI: 1.15–2.14,  $p < 0.01$ ) and those who lived alone (OR = 2.44, 95% CI: 1.52–3.90,  $p < 0.001$ ) had higher odds of having a total ban on smoking in home (Table 3).

## DISCUSSION

Voluntary implementation of total ban on smoking in home is one of the most important actions to reduce exposure to secondhand smoke. During the COVID-19 pandemic, millions of Poles stayed at home, so providing a smoke-free environment at home may allow reducing the negative impact of lock-down on health. Finding from this study showed that less than two-thirds of Polish adults had implemented full smoke-free home rule. Compared to data from 2019, the percentage of Polish inhabitants who implemented total ban on smoking in home has decreased (from 66.1% in 2019 [16] to 60.6% in 2022). Even though 34% of Polish adults had implemented a partial smoke-free home rule, this rule does not protect all citizens from SHS exposure. In multivariate logistic regression analysis, males, non-smokers, respondents who had higher education as well as those who lived alone had higher odds of implementing a total ban on smoking in home.

Over one-quarter of adults in Poland smoke cigarettes [24,25]. Smokers, who worked remotely during

the COVID-19 pandemic had to change their daily habits and find new places where they smoke, during their working days. Smoking was recognized as a risk factor for severe COVID-19 [26]. Due to this fact, smokers were advised to quit smoking during the COVID-19 pandemic. However, previously published data showed, that between April and May 2020 (first wave of the pandemic), approx. 45% of smokers in Poland experienced a rise in smoking [20]. The number of household members staying together in the same house for a long time (mostly due to remote work or distance learning) often required changing behavior and defining rules for living together. While the COVID-19 infection prevention rules were widely discussed in the media in Poland, there were no nationwide public health actions promoting the implementation of smoke-free home rules.

This study was carried out 2 years after the COVID-19 pandemic onset in Poland. Compared to September 2019, the percentage of non-smokers who implemented total smoke-free home rules decreased from 79.8% to 76.8% [16]. However, between 2019 and 2022 the prevalence of 100% smoke-free home rules among smokers increased from 18.6% [16] to 20.7%. Moreover, the percentage of non-smokers who implemented a partial ban increased from 24.6% in 2019 [16] to 34.0% in 2022. The authors



can hypothesize that some smokers tried to reduce SHS emissions by smoking only in designated rooms or on balconies or terraces. Nevertheless, only a total smoking ban significantly decreases SHS exposure in households [7–9]. Public awareness of the negative impact of SHS exposure on health may drive a change in the implementation of smoke-free home rules. Between 2019 and 2022, the prevalence of partial smoke-free home rules increased, but the prevalence of total smoke-free home rules decreased during the COVID-19 pandemic. The authors can hypothesize, that smokers could adopt partial ban on smoking in home to protect their relatives, but this action was insufficient to provide 100% smoke-free environment. Moreover, changes in the national tobacco control act also impact the changes in smoking behaviors among Poles, including the implementation of smoke-free home rules [14,16]. Between 2009–2010 and 2019, the overall prevalence of 100% smoke-free home rules in Poland increased from 37.1% to 66.1% [15,16]. However, in 2010 and 2016 smoke-free law has been amended (2010 – extending the smoking ban to additional public venues; 2016 – e-cigarette use was banned in the same places as the smoking ban) [14]. The authors can hypothesize, that lack of changes in smoke-free laws in Poland during the COVID-19 pandemic may discourage the public from implementing smoke-free home rules. For example, there is a public debate on a ban on residents smoking near windows or on the balconies of their homes [9]. The implementation of this ban may significantly increase the percentage of Polish inhabitants who implemented ban on smoking in home. Findings from the Polish branch of the Global Adult Tobacco Survey (GATS; wave 2009/2010) showed, that current smoking, lower educational level, living with smoker, low level of awareness of health effects of SHS exposure were associated with a decreased likelihood of adopting 100% smoke-free home rules [15]. In 2019 among individuals aged  $\geq 15$  in Poland, out of 6 analyzed factors, only smoking status was significantly associated with the im-

plementation of total ban on smoking [16]. In this study, males, non-smokers, respondents who had higher education as well as those who lived alone had higher odds of having a 100% smoke-free home rule. Moreover, the prevalence of 100% smoke-free home rules was lower among those participants, who have children or lived with underage children. This is particularly worrying as children are particularly sensitive to the negative health effects of SHS exposure. Differences between this study and studies carried out in 2009–2010 and 2019 may result from social changes taking place in Poland as well as the remarkable impact of the COVID-19 pandemic and lock-down on lifestyle and health choices [18,20,21].

This study showed that the prevalence of total smoke-free home rules in Poland (60.6%) is lower than reported in the U.S. (83.7%) [27], and comparable to those observed in South Africa (62.5%) [28] or Japan (55.1%) [29]. The authors' findings confirmed that there is a need to increase public awareness of SHS exposure and promote implementation of 100% smoke-free home rules also in high-income countries. Adults who work in a smoke-free workplace are significantly more likely to implement ban on smoking in home [30]. Elimination of SHS exposure should base on comprehensive smoke-free law, including both public and private venues.

This study has several practical implications. First, the negative impact of the COVID-19 pandemic on the implementation of smoke-free home rules was observed. Secondly, the findings indicate significant gaps in the adoption of 100% smoke-free home rules between different sociodemographic groups, especially those without higher education. Educational campaigns are needed to increase public awareness of tobacco-related diseases (including those resulting from SHS exposure). Moreover, these findings provide baseline information for policymakers. National Tobacco Control Act should be strengthened to eliminate tobacco smoke from public and private places.

This study has some limitations. Data were collected using the computer-assisted web interviewing (CAWI) technique, so only subjects who have internet access were included. Nevertheless, >92% of Polish inhabitants have internet access. Moreover, interactions with the respondents were not possible. In this cross-sectional survey, secondhand smoke exposure was not verified, due to the high risk of misinterpretation of questions related to secondhand smoke exposure, as well as the lack of access to markers of SHS exposure.

## CONCLUSIONS

This study demonstrated the decrease in the implementation of smoke-free home rules in Poland during the COVID-19 pandemic. This study provided baseline information for further implementation of the smoke-free policies in Poland. There is an urgent need to promote smoke-free home rules, especially among smokers, females as well as individuals without higher education. Physicians should ask smokers about the smoke-free rules in home and promote the implementation of a total ban on smoking. Sociodemographic differences in the implementation of smoke-free home rules revealed in this study suggest that personalized communication and motivational interviewing should be considered as a part of public health interventions to promote smoke-free environments.

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