

# BMJ Open Public support for car smoking bans in Poland: a 2022 national cross-sectional survey

Aurelia Ostrowska, Mateusz Jankowski , Jarosław Pinkas

**To cite:** Ostrowska A, Jankowski M, Pinkas J. Public support for car smoking bans in Poland: a 2022 national cross-sectional survey. *BMJ Open* 2022;**12**:e066247. doi:10.1136/bmjopen-2022-066247

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-066247>).

Received 30 June 2022

Accepted 30 September 2022

## ABSTRACT

**Objective** The objectives of this study were to assess the prevalence of self-reported secondhand smoke exposure in cars among adults in Poland and to characterise public attitudes towards the implementation of the ban on smoking in cars with children.

**Design** Cross-sectional survey was carried out between 4 March 2022 and 7 March 2022 on a national sample of 1090 adult Polish residents. The questionnaire included 12 closed questions on smoking behaviours, secondhand smoke exposure as well as attitudes towards different smoke-free laws.

**Participants** Data were obtained from 1090 individuals, aged 18–84 years, 52.6% were females.

**Results** Almost every fifth respondent (17.7%) declared secondhand smoke exposure in cars in the past 30 days (31.8% of smokers and 12.0% of non-smokers;  $p<0.001$ ). Lack of the implementation of smoke-free home rules (aOR 2.92, 95% CI 1.99 to 4.29;  $p<0.001$ ), age 18–29 years (aOR 2.06; 95% CI 1.16 to 3.67;  $p=0.01$ ), current smoking (aOR 1.99, 95% CI 1.37 to 2.90;  $p<0.001$ ) as well as bad financial situation (aOR 1.60, 95% CI 1.02 to 2.48;  $p=0.04$ ) were significantly associated with the higher risk of secondhand smoke exposure in cars. Out of all respondents, 84.2% supported the implementation of the ban on smoking in cars with children. Out of 12 different sociodemographic factors, only the female gender (aOR 1.94, 95% CI 1.37 to 2.74) and being non-smokers (aOR 1.70, 95% CI 1.20 to 2.41;  $p=0.003$ ) were significantly associated with the higher odds of supporting the implementation of the ban on smoking in cars with children.

**Conclusions** This study showed high public support for the implementation of the ban on smoking in cars with children. Social support for smoke-free environments in Poland should be used by public health specialists and policy-makers to strengthen the national tobacco control act.

## INTRODUCTION

Secondhand smoke exposure is a well-documented risk factor for cardiovascular diseases, lung diseases as well as cancers.<sup>1 2</sup> It is estimated that more than 1 million people every year die due to secondhand smoke exposure.<sup>3</sup> Moreover, children exposed to secondhand smoke are at greater risk for tobacco use in adolescence.<sup>4</sup> Exposure of unborn

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study was carried out on a national sample of adults in Poland.
- ⇒ A logistic regression analyses were used to identify factors associated with public support for the implementation of the ban on smoking in cars with children.
- ⇒ Secondhand smoke exposure in cars was defined based on self-report, which may pose demand bias or recall bias.
- ⇒ Secondhand smoke exposure among children was not verified in this study.

children to secondhand smoke may lead to birth defects, stillbirths, preterm births and infant deaths.<sup>3</sup> Moreover, children living with smokers are at higher risk of developing lung disease (bronchiolitis, pneumonia and respiratory infection), early mortality and addiction due to nicotine effects in the brain.<sup>3 5</sup>

Secondhand smoke exposure mostly occurs in the home or workplace.<sup>3–5</sup> Moreover, staying in selected public places (eg, bars and restaurants) may be associated with a greater risk of exposure to secondhand smoke.<sup>5</sup> Findings from the cross-sectional surveys among adolescents and young adults also showed that a markable proportion of youth may be exposed to secondhand smoke in cars and private vehicles.<sup>6 7</sup> Moreover, sociodemographic factors such as educational level, financial situation and individual health literacy levels may influence the risk of exposure to secondhand smoke.<sup>3–6</sup>

The WHO Framework Convention on Tobacco Control encourages the Member States to implement comprehensive smoke-free laws that protect non-smokers from secondhand smoke exposure.<sup>8</sup> Moreover, the implementation of smoke-free laws may encourage smokers to quit as well as prevent smoking initiation among adolescents.<sup>9 10</sup> However, countries across the world differ in the implementation of smoke-free laws, the extension of policies and places (both



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

School of Public Health, Centre of Postgraduate Medical Education, Warsaw, Poland

### Correspondence to

Dr Mateusz Jankowski; [mjankowski@cmkp.edu.pl](mailto:mjankowski@cmkp.edu.pl)



indoor and outdoor) where smoking is prohibited.<sup>11 12</sup> The prevalence of secondhand smoke exposure is higher among low-income and middle-income countries.<sup>13</sup> It is estimated that only one-third of the countries have implemented a comprehensive ban on smoking in public places.<sup>14</sup> Organisational factors, political polarisation and the lack of social support are recognised as major barriers to the implementation of national smoke-free laws.<sup>15 16</sup>

Poland is an example of a former communist country in Central and Eastern Europe, that passes the first smoke-free law.<sup>17 18</sup> In 1995, ban on smoking in healthcare facilities, schools and other educational facilities as well as enclosed workplaces and several public places was implemented.<sup>17 18</sup> The implementation of smoke-free law was supported by a coalition of experts (including doctors, public health specialists and scientific societies), efforts to build political consensus as well as public debate on tobacco use and media anti-tobacco campaigns (eg, 'Let's Stop Smoking Together').<sup>18</sup> In 2010, the smoke-free law was extended to new places where smoking is prohibited, and in 2016, e-cigarette use in public places was banned.<sup>17</sup> Over 10 years after the markable amendment of the smoke-free law in Poland (2009–2019), a substantial reduction in secondhand exposure was observed in all public venues.<sup>17</sup> However, significant gaps in the implementation of smoke-free laws in private venues are observed.<sup>19</sup> In 2019, only 66.1% of Poles adopted a full smoke-free home rule in their homes.<sup>19</sup> There is a public debate on the implementation of the ban on smoking on apartment balconies. Moreover, some European countries (eg, Cyprus, France, UK) enforced the ban on smoking in private cars with minors.<sup>11 20</sup> Out of 12 European countries participating in the TackSHS Survey (2017–2018), Poland was the country with the lowest level of public support for the implementation of the ban on smoking in cars with children.<sup>11</sup> In 2018–2018, only 59.8% of non-smokers in Poland declared their support for the implementation of the ban on smoking in private cars with children.<sup>11</sup>

The COVID-19 pandemic has had a markable impact on public attitudes towards tobacco use.<sup>21</sup> Between 2019 and 2022, the prevalence of daily smoking in Poland increased from 21% to 28.8%.<sup>22</sup> At the same time, an increase in public awareness of smoking-related diseases was observed.<sup>23</sup> Regular monitoring of public attitudes towards tobacco use, smoke-free laws and antitobacco legislation is the critical anti-tobacco measures recommended by the WHO in the MPOWER package.<sup>24</sup> However, there is a lack of data on public attitudes towards the extension of the national smoke-free law in Poland, including private cars.

Therefore, the objectives of this study were to assess: (1) the prevalence of self-reported secondhand smoke exposure in cars; (2) public attitudes towards the implementation of the ban on smoking in cars with children, and (3) to identify factors associated with public support for the implementation of the ban on smoking in cars with children.

## METHODS

### Study design and sample

This cross-sectional survey was carried out between 4 March 2022 and 7 March 2022, on a national sample of 1090 adult inhabitants of Poland. Data were collected by the professional public opinion research company (Nationwide Research Panel Ariadna, Warsaw, Poland),<sup>25</sup> on behalf of the research team, which provides the scientific context for this study. Computer-assisted web interview (CAWI) technique was used. Data collection methods were precisely described in previously published papers that are published within the same scientific project.<sup>22 23</sup>

Respondents were selected from more than 100 thousand registered and verified individuals, that actively participate in the surveys carried out by the Nationwide Research Panel Ariadna, Warsaw, Poland.<sup>25</sup> A non-probability quota sampling technique was applied.<sup>25</sup> The stratification model included the following variable: gender, age, size and location of the place of residence. The stratification was based on sociodemographic datasets collected and published Central Statistical Office of the Republic of Poland, Warsaw, Poland.<sup>26</sup>

### Participants and public involvement

Participants in this study were not involved in the development of the design or recruitment. Results will be disseminated via publication in an open-access journal.

### Measures

A self-prepared questionnaire was used.<sup>22 23</sup> The questionnaire included 12 closed questions on tobacco use, tobacco-related diseases, secondhand smoke exposure as well as attitudes towards different smoke-free laws. Moreover, sociodemographic questions were addressed.

Self-reported secondhand smoke exposure in cars: Respondents were asked about exposure to secondhand smoke in cars, using the following question: 'In the last 30 days, have you been exposed to secondhand smoke in a private car (your car or a car that you travel regularly)? (yes/no)'. Respondents who answered 'yes' were classified as those who were exposed to secondhand smoke in cars.

Public attitudes towards the implementation of the ban on smoking in cars with children: Respondents were asked about their attitudes towards the implementation of the ban on smoking in cars with children, using the question: 'How much do you agree or disagree with the following statement: smoking in a car with children/minors under the 18 years of age should be banned by the law', with five possible answers: 'strongly agree', 'rather agree', 'rather disagree', 'strongly disagree' or 'do not know/difficult to tell'.

Respondents, who indicated 'strongly agree' or 'rather agree', were classified as those who support the implementation of the ban on smoking in cars with children.

**Table 1** Characteristics of the study population (n=1090)

Variable	n	%
Gender		
Female	573	52.6
Male	517	47.4
Age (years)		
18–34	354	32.5
35–49	285	26.1
45–64	290	26.6
65+	161	14.8
Marital status		
Ever married	682	62.6
Never married	408	37.4
Educational level		
Higher	450	41.3
Less than higher	640	58.7
Occupational status		
Active	659	60.5
Passive	431	39.5
Self-reported financial situation		
Good	455	41.7
Moderate	424	38.9
Bad	211	19.4
Having children		
Yes	707	64.9
No	383	35.1
Children under 18 years in home		
Yes	347	31.8
No	743	68.2
No of household members		
1	161	14.8
2 or more	929	85.2
Ban on smoking in home		
Yes	661	60.6
No	429	39.4
Place of residence		
Rural	339	31.1
City below 20000 residents	138	12.7
City from 20000 to 99999 residents	253	23.2
City from 100000 to 499999 residents	211	19.4
City above 500000 residents	149	13.7
Smoking status		
Current smoker	314	28.8
Current non-smoker	776	71.2

### Data analysis

All statistical calculations were performed using SPSS V.28 (IBM). The distribution of categorical variables was shown by frequencies and proportions. Cross-tabulations and  $\chi^2$  tests were used to compare categorical variables.

Associations between personal characteristics (gender; age; marital status; having higher education; occupational status; self-reported financial situation; having children; children under 18 years in the home; the number of household members; place of residence), smoke-free home rules and smoking status with (1) secondhand smoke exposure and (2) attitude towards the implementation of the ban on smoking in cars with children were analysed using the logistic regression analyses. In univariate logistic regression analyses, all variables were considered separately. Multivariate logistic regression analyses included all the variables significantly associated with awareness of selected tobacco-related diseases in univariate models. The strength of association was measured by the OR and 95% CIs. Statistical inference was based on the criterion  $p < 0.05$ .

## RESULTS

### Characteristics of the study population

This study is based on the responses received from 1090 adults (52.6% females) in Poland. Among the respondents, 28.8% were smokers. Almost two-thirds of respondents (60.6%) lived in completely smoke-free homes. The sociodemographic characteristics of the study population is presented in [table 1](#).

### Self-reported secondhand smoke exposure in cars

Almost every fifth respondent (17.7%) declared secondhand smoke exposure in cars in the past 30 days ([table 2](#)). The prevalence of secondhand smoke exposure decreased with the age ( $p < 0.001$ ). Respondents who had children more often declared secondhand smoke exposure in cars in the past 30 days, compared with those who did not have children (21.6% vs 15.9%;  $p = 0.02$ ). The prevalence of secondhand smoke exposure in cars was three times higher among those respondents without the complete ban on smoking in the home compared with those who implemented smoke-free home rules (30.1% vs 9.7%;  $p < 0.001$ ). Moreover, the prevalence of secondhand smoke exposure in cars among smokers was more than two times higher (31.8% vs 12.0%;  $p < 0.001$ ) than among non-smokers.

Self-reported secondhand smoke exposure in cars by smoking status is presented in [table 2](#).

In multivariate logistic regression analysis ([table 3](#)), younger (18–29 years) age (aOR 2.06; 95% CI 1.16 to 3.67;  $p = 0.01$ ), bad financial situation (aOR 1.60, 95% CI 1.02 to 2.48;  $p = 0.04$ ), lack of the implementation of smoke-free home rules (aOR 2.92, 95% CI 1.99 to 4.29;  $p < 0.001$ ) as well as current smoking (aOR 1.99, 95% CI 1.37 to 2.90;  $p < 0.001$ ) were significantly associated with the higher risk of secondhand smoke exposure in cars in the past 30 days ([table 3](#)).

### Public attitudes towards the implementation of the ban on smoking in cars with children

Among the respondents, 64.3% strongly agreed with the statement that smoking in cars with children/minors

**Table 2** Self-reported secondhand smoke exposure in cars in the past 30 days by smoking status (n=1090)

Variable	Self-reported secondhand smoke exposure in cars in the past 30 days								
	Overall n=1090			Non-smokers n=776			Smokers n=314		
	n	%	P value	n	%	P value	n	%	P value
Overall	193	17.7		93	12		100	31.8	
Gender									
Female	98	17.1	0.6	56	13.4	0.2	42	27.1	0.07
Male	95	18.4		37	10.3		58	36.5	
Age (years)									
18–34	82	23.2	<b>&lt;0.001</b>	41	16.1	<b>0.01</b>	41	41.4	0.053
35–49	55	19.3		27	14.1		28	30.1	
45–64	36	12.4		16	7.9		20	22.7	
65+	20	12.4		9	7.1		11	32.4	
Marital status									
Ever married	109	16	0.054	51	10.5	0.1	58	29.4	0.2
Never married	84	20.6		42	14.4		42	35.9	
Educational level									
Higher	5	22.7	0.03	34	9.7	0.07	32	32.3	0.9
Less than higher	127	19.8		59	13.9		68	31.6	
Occupational status									
Active	128	19.4	0.07	58	12.9	0.3	70	33.3	0.4
Passive	65	15.1		35	10.7		30	28.8	
Self-reported financial situation									
Good	71	15.6	0.1	31	9.6	0.2	40	30.5	0.2
Moderate	75	17.7		44	14.1		31	27.9	
Bad	47	22.3		18	12.9		29	40.3	
Having children									
Yes	117	16.5	0.2	47	9.7	<b>0.01</b>	70	31.3	0.7
No	76	19.8		46	15.7		30	33.3	
Children under 18 years in home									
Yes	75	21.6	<b>0.02</b>	33	14.4	0.2	42	35.6	0.3
No	118	15.9		60	11		58	29.6	
No of household members									
1	21	13	0.09	10	8.5	0.2	11	25.6	0.3
2 or more	172	18.5		83	12.6		89	32.8	
Ban on smoking in home									
Yes	64	9.7	<b>&lt;0.001</b>	53	8.9	<b>&lt;0.001</b>	11	16.9	<b>0.004</b>
No	129	30.1		40	22.2		89	35.7	
Place of residence									
Rural	68	20.1	0.051	39	15.7	0.2	29	32.2	0.1
City below 20000 residents	15	10.9		8	8.3		7	16.7	
City from 20000 to 99999 residents	53	20.9		21	12.3		32	39	
City from 100000 to 499999 residents	37	17.5		14	9.6		23	35.4	
City above 500000 residents	20	13.4		11	9.6		9	25.7	

under 18 years of age should be prohibited, and 19.9% rather agreed with this statement (table 4). Out of all respondents, 84.2% supported (strongly agree or rather agree) the implementation of the ban on smoking in cars with children. Less than 5% of respondents declared that

they strongly disagree with the statement that smoking in cars with children should be prohibited by the law. Among the respondents, 7% did not have clearly defined attitudes towards the implementation of the ban on smoking in cars with children (table 4). The percentage



**Table 3** Factors associated with self-reported secondhand smoke exposure in cars in the past 30 days (n=1090)

Variable	Self-reported secondhand smoke exposure in cars in the past 30 days					
	Univariate logistic regression			Multivariate logistic regression		
	P value	OR	95% CI	P Value	aOR	95% CI
Gender						
Female	0.6	0.92	0.67 to 1.25			
Male		1	Reference			
Age (years)						
18–34	<b>0.005</b>	2.13	1.25 to 3.61	<b>0.01</b>	2.06	1.16 to 3.67
35–49	0.06	1.69	0.97 to 2.93	0.3	1.38	0.74 to 2.55
45–64	0.9	1.00	0.56 to 1.79	0.5	0.81	0.44 to 1.49
65+		1	Reference		1	Reference
Marital status						
Ever married		1	Reference			
Never married	0.054	1.36	0.99 to 1.87			
Educational level						
Higher		1	Reference		1	Reference
Less than higher	<b>0.03</b>	1.44	1.04 to 1.99	0.6	1.11	0.78 to 1.57
Occupational status						
Active	0.07	1.36	0.98 to 1.88			
Passive		1	Reference			
Self-reported financial situation						
Good		1	Reference		1	Reference
Moderate	0.4	1.16	0.82 to 1.66	0.37	1.19	0.82 to 1.74
Bad	<b>0.04</b>	1.55	1.03 to 2.34	<b>0.04</b>	1.60	1.02 to 2.48
Having children						
Yes	0.2	0.80	0.58 to 1.10			
No		1	Reference			
Children under 18 years in home						
Yes	<b>0.02</b>	1.46	1.06 to 2.02	0.05	1.15	0.79 to 1.67
No		1	Reference		1	Reference
No of household members						
1		1	Reference			
2 or more	0.1	1.52	0.93 to 2.47			
Ban on smoking in home						
Yes		1	Reference		1	Reference
No	<b>&lt;0.001</b>	4.01	2.88 to 5.58	<b>&lt;0.001</b>	2.92	1.99 to 4.29
Place of residence						
Rural	0.08	1.62	0.94 to 2.78			
City below 20 000 residents	0.51	0.79	0.39 to 1.61			
City from 20 000 to 99 999 residents	0.06	1.71	0.98 to 3.00			
City from 100 000 to 499 999 residents	0.3	1.37	0.76 to 2.47			
City above 500 000 residents		1	Reference			
Smoking status						
Smoker	<b>&lt;0.001</b>	3.43	2.49 to 4.73	<b>&lt;0.001</b>	1.99	1.37 to 2.90
Non-smoker		1	Reference		1	Reference

of respondents who supported the implementation of the ban on smoking in cars with children was significantly higher among females as well as older respondents

( $p < 0.001$ ). Moreover, those who had ever been married, currently unemployed respondents (passive occupational status), those who had as least one child as well

**Table 4** Public attitudes towards the implementation of ban on smoking in cars with children (n=1090)

Variable	Public attitudes towards the implementation of ban on smoking in cars with children										P value
	Strongly agree		Rather agree		Rather disagree		Strongly disagree		Do not know/ difficult to tell		
	n	%	n	%	n	%	n	%			
Overall	701	64.3	217	19.9	46	4.2	50	4.6	76	7.0	
Gender											
Female	383	66.8	125	21.8	19	3.3	14	2.4	32	5.6	<b>&lt;0.001</b>
Male	318	61.5	92	17.8	27	5.2	36	7.0	44	8.5	
Age (years)											
18–34	206	58.2	81	22.9	19	5.4	20	5.6	28	7.9	<b>&lt;0.001</b>
35–49	165	57.9	64	22.5	11	3.9	17	6.0	28	9.8	
45–64	201	69.3	54	18.6	9	3.1	10	3.4	16	5.5	
65+	129	80.1	18	11.2	7	4.3	3	1.9	4	2.5	
Marital status											
Ever married	461	67.6	127	18.6	27	4.0	25	3.7	42	6.2	<b>0.04</b>
Never married	240	58.8	90	22.1	19	4.7	25	6.1	34	8.3	
Educational level											
Higher	298	66.2	83	18.4	19	4.2	23	5.1	27	6.0	0.6
Less than higher	403	63.0	134	20.9	27	4.2	27	4.2	49	7.7	
Occupational status											
Active	405	61.5	136	20.6	29	4.4	39	5.9	50	7.6	<b>0.04</b>
Passive	296	68.7	81	18.8	17	3.9	11	2.6	26	6.0	
Self-reported financial situation											
Good	316	69.5	79	17.4	13	2.9	21	4.6	26	5.7	0.09
Moderate	251	59.2	94	22.2	22	5.2	19	4.5	38	9.0	
Bad	134	63.5	44	20.9	11	5.2	10	4.7	12	5.7	
Having children											
Yes	480	67.9	130	18.4	26	3.7	30	4.2	51	5.8	<b>0.02</b>
No	221	57.7	87	22.7	20	5.2	20	5.2	35	9.1	
Children under 18 years in home											
Yes	222	64.0	72	20.7	13	3.7	17	4.9	23	6.6	0.9
No	479	64.5	145	19.5	33	4.4	33	4.4	53	7.1	
No of household members											
1	99	61.5	35	21.7	8	5.0	11	6.8	8	5.0	0.4
2 or more	602	64.8	182	19.6	38	4.1	39	4.2	68	7.3	
Ban on smoking in home											
Yes	461	69.7	104	15.7	25	3.8	24	3.6	47	7.1	<b>&lt;0.001</b>
No	240	55.9	113	26.3	21	4.9	26	6.1	29	6.8	
Place of residence											
Rural	205	60.5	74	21.8	14	4.1	18	5.3	28	8.3	0.7
City below 20 000 residents	81	58.7	28	20.3	9	6.5	8	5.8	12	8.7	
City from 20 000 to 99 999 residents	173	68.4	42	16.6	11	4.3	11	4.3	16	6.3	
City from 100 000 to 499 999 residents	139	65.9	44	20.9	9	4.3	7	3.3	12	5.7	
City above 500 000 residents	103	69.1	29	19.5	3	2.0	6	4.0	8	5.4	
Smoking status											
Current smoker	166	52.9	81	25.8	19	6.1	22	7.0	26	8.3	<b>&lt;0.001</b>
Current non-smoker	535	68.9	136	17.5	27	3.5	28	3.6	50	6.4	

as respondents who implemented a complete ban on smoking in the home more often declared support for the implementation of the ban on smoking in cars with children ( $p < 0.05$ ). More than 15% of smokers were against the implementation of the ban on smoking in cars with children (table 4).

In multivariate logistic regression analysis (table 5), only females (aOR 1.94, 95% CI 1.37 to 2.74) and current non-smokers (aOR 1.70, 95% CI 1.20 to 2.41;  $p = 0.003$ ) had higher odds of supporting the implementation of the ban on smoking in cars with children (table 5).

## DISCUSSION

This is the most up-to-date study on public attitudes towards the implementation of the ban on smoking in cars with children in Poland. Two years after the COVID-19 pandemic onset in Poland, the majority of adults (84.2%) declared support for the implementation of the ban on smoking in cars with children. Out of 12 different variables analysed in this study, only gender and smoking status were significantly associated with public attitudes towards strengthening the tobacco control act. Lack of differences by age, educational level, place of residence and financial situation points to a national consensus in understanding the need to protect children from exposure to secondhand smoke in cars, irrespective of socioeconomic variables.

In 2010, Poland has passed an amendment to the national tobacco control act that has a significant impact on the reduction of secondhand smoke exposure in public venues.<sup>17 27</sup> Between 2009 and 2019, the percentage of non-smokers exposed to secondhand smoke in the workplace decreased from 19.2% to 6.5%. Even a greater decrease in secondhand smoke exposure was observed in bars/pubs—from 39.4% in 2009 to 7.0% in 2019.<sup>17</sup> However, despite the implementation of smoke-free rules, still, 11.7% of Poles were exposed to secondhand smoke in public transport stops and facilities and 3.0% declared exposure to secondhand smoke in public transportation vehicles.<sup>17</sup> In this study, 17.7% of all respondents declared exposure to secondhand smoke in private cars, wherein smokers more often declared exposure to secondhand smoke than non-smokers (31.8% vs 12.0%;  $p < 0.001$ ). The percentage of Poles exposed to secondhand smoke in private cars indicates is higher than the percentage of Poles exposed to secondhand smoke in public venues. Moreover, in this study, the highest risk of secondhand smoke exposure was among the youngest respondents aged 18-29 years. We can hypothesise that young adults are travelling with friends or family, which may expose them to secondhand smoke. For example, the percentage of smokers is relatively high among university students,<sup>28</sup> so travelling by car to universities can be a source of exposure to secondhand smoke if one of the passengers smokes. Moreover, a bad financial situation was also associated with a higher risk of secondhand smoke exposure in the car. Low socioeconomic status is

usually associated with higher exposure to secondhand smoke, probably due to the higher prevalence of smoking and lower levels of health literacy.<sup>4-6 29</sup> We can hypothesise that financial constraints may be the main reason for higher exposure to secondhand smoke in the car among vulnerable populations.<sup>29</sup>

In this study, we also analysed the impact of voluntary smoke-free homes on the exposure to secondhand smoke in cars as well as attitudes towards the implementation of the ban on smoking in cars with children. The home environment is one of the most common places where individuals may be exposed to secondhand smoke.<sup>1 4 5</sup> Voluntary implementation of smoke-free home rules in private homes may also shape public attitudes towards the ban on smoking in cars. In this study, Respondents who do not have any smoke-free home rules had almost three times higher risk of secondhand smoke exposure in cars, compared with those individuals who voluntarily implemented the ban on smoking in homes. This finding underlines the importance of comprehensive smoke-free policies, that promote the implementation of the ban on smoking, also in selected private venues (eg, cars with minors or apartment balconies).<sup>20 21</sup>

In this study, the majority of Poles (84.2%) declared their support for the implementation of the ban on smoking in cars with children. We observed a markable increase in the percentage of non-smokers who support the ban on smoking in cars with minors, compared with data from 2017 to 2018, where only 59.8% of non-smokers in Poland supported the implementation of the ban on smoking in cars with children.<sup>11</sup> We can hypothesise that the COVID-19 pandemic and the education on the transmission methods (air contaminated by droplets/aerosols) may have a positive impact on public awareness of respiratory health and the harmful effect of other respiratory hazards like air pollution.<sup>21 23</sup> During the COVID-19 pandemic, an increase in public support for the implementation of smoke-free zones was also observed in Saudi Arabia<sup>30</sup> and Israel.<sup>31</sup>

Out of 12 different sociodemographic factors, only the female gender and being non-smokers were significantly associated with the higher odds of supporting the implementation of the ban on smoking in cars with children. Numerous studies showed that smokers are less likely to support smoke-free laws.<sup>19 20</sup> We can hypothesise that females are more likely to support the ban on smoking in cars with children, due to their social role and family model in Poland, where the females are mostly responsible for caregiving. Findings from this study showed that there is a nationwide consensus between sociodemographic groups on the importance of the implementation of the ban on smoking in cars with children, as there was no significant impact of sociodemographic factors on the public attitudes towards the implementation of the ban on smoking in cars with children.

The implementation of the ban on smoking in cars with children has been documented as an effective way to reduce secondhand smoke exposure among children.<sup>32 33</sup>

**Table 5** Factors associated with the public support for the implementation of ban on smoking in cars with children (n=1090)

Variable	Public support for the implementation of ban on smoking in cars with children							
	P value	N (%)	Univariate logistic regression			Multivariate logistic regression		
			P value	OR	95% CI	P value	aOR	95% CI
Gender								
Female	<b>&lt;0.001</b>	508 (88.7)	<b>&lt;0.001</b>	2.04	1.46 to 2.85	<b>&lt;0.001</b>	1.94	1.37 to 2.74
Male		410 (79.3)		1	Reference		1	Reference
Age (years)								
18–34	<b>&lt;0.001</b>	287 (81.1)		1	Reference		1	Reference
35–49		229 (80.4)	0.8	0.96	0.64 to 1.42	0.5	0.87	0.57 to 1.35
45–64		255 (87.9)	0.2	1.70	1.09 to 2.65	0.2	1.37	0.83 to 2.28
65+		147 (91.3)	<b>0.004</b>	2.45	1.33 to 4.51	0.06	2.03	0.98 to 4.22
Marital status								
Ever married	<b>0.02</b>	588 (86.2)	<b>0.02</b>	1.48	1.06 to 2.06	0.9	0.99	0.62 to 1.59
Never married		330 (80.9)		1	Reference		1	Reference
Educational level								
Higher	0.7	381 (84.7)	0.7	1.06	0.76 to 1.48			
Less than higher		537 (83.9)		1	Reference			
Occupational status								
Active	<b>0.02</b>	541 (82.1)		1	Reference		1	Reference
Passive		377 (87.5)	<b>0.02</b>	1.52	1.08 to 2.16	0.9	1.03	0.69 to 1.55
Self-reported financial situation								
Good	0.09	395 (86.8)	0.4	1.22	0.77 to 1.93			
Moderate		345 (81.4)	0.4	0.81	0.52 to 1.26			
Bad		178 (84.4)		1	Reference			
Having children								
Yes	<b>0.01</b>	610 (86.3)	<b>0.01</b>	1.53	1.10 to 2.13	0.3	1.33	0.82 to 2.16
No		308 (80.4)		1	Reference		1	Reference
Children under 18 years in home								
Yes	0.8	294 (84.7)	0.8	1.06	0.74 to 1.50			
No		624 (84.0)		1	Reference			
No of household members								
1	0.7	134 (83.2)		1	Reference			
2 or more		784 (84.4)	0.7	1.09	0.70 to 1.71			
Ban on smoking in home								
Yes	0.2	565 (85.5)	0.2	1.27	0.91 to 1.76			
No		353 (82.3)		1	Reference			
Place of residence								
Rural	0.1	279 (82.3)		1	Reference			
City below 20 000 residents		109 (79.0)	0.4	0.81	0.49 to 1.33			
City from 20 000 to 99 999 residents		215 (85.0)	0.4	1.22	0.78 to 1.90			
City from 100 000 to 499 999 residents		183 (86.7)	0.2	1.41	0.87 to 2.29			
City above 500 000 residents		132 (88.6)	0.08	1.67	0.94 to 2.97			
Smoking status								
Smoker	<b>0.001</b>	247 (78.7)		1	Reference		1	Reference

Continued



Table 5 Continued

Variable	Public support for the implementation of ban on smoking in cars with children							
			Univariate logistic regression			Multivariate logistic regression		
	P value	N (%)	P value	OR	95% CI	P value	aOR	95% CI
Non-smoker		671 (86.5)	<b>0.001</b>	1.73	1.24 to 2.43	<b>0.003</b>	1.70	1.20 to 2.41

Bold values are statistically significant levels (p<0.05).

The age of the child that is covered by the ban differs across the European countries (under the age of 12 in France and Greece, to under the age of 16 in Cyprus).<sup>20 33</sup> Moreover, some tobacco control researchers point out the need to implement a comprehensive ban on smoking in cars with children, which will also include electronic cigarettes.<sup>34</sup> Ravara *et al* showed, that despite the strong ban support, poor enforcement may contribute to low compliance and exposure to secondhand smoke exposure in cars.<sup>35</sup> As partial and poorly enforced ban is vulnerable to breaches, a comprehensive smoke-free policy is needed.<sup>35</sup>

This study has practical implications for public health specialists and policymakers in Poland. First of all, this study confirmed that there is high public support for the implementation of the ban on smoking in private cars with children. Second, this study showed that there is a lack of sociodemographic differences in the public attitudes towards the extension of the tobacco control acts, which will also include a ban on smoking in private vehicles. Third, this study underlines the further need to strengthen tobacco control policy in Poland, which will reduce secondhand smoke exposure in public and selected private venues.

There are several limitations of this study. The secondhand smoke exposure was based on self-reported data. Due to the cross-sectional design of this study, atmospheric and biological markers of secondhand smoke exposure in cars have not been evaluated.<sup>36</sup> Only adult inhabitants of Poland were included in this study, so secondhand smoke exposure among minors has not been verified. Moreover, data were collected using the CAWI technique that may exclude those individuals that do not have internet access, so we cannot exclude a selection bias.

## CONCLUSIONS

This study showed high public support for the implementation of the ban on smoking in cars with children. Social support for smoke-free environments in Poland should be used by public health specialists and policymakers to strengthen the tobacco control act. Despite the ban on smoking in numerous public venues in Poland, still, a markable proportion of Poles is exposed to secondhand smoke in private cars. As there is no safe level of secondhand smoke exposure, public actions are needed to provide smoke-free environments.

**Twitter** Mateusz Jankowski @MateJankowski

**Contributors** All authors (AO, MJ and JP) have contributed significantly to this work, have seen the contents of the manuscript and agreed to its submission. All the co-authors accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Consent obtained directly from patient(s).

**Ethics approval** The study protocol was approved by the Ethical Review Board at the Centre of Postgraduate Medical Education, Warsaw, Poland (approval no. 21/2022). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available on reasonable request.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

## ORCID iD

Mateusz Jankowski <http://orcid.org/0000-0002-7142-5167>

## REFERENCES

- 1 United States Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Washington, DC: US Govt Printing Office, 2006.
- 2 Dunbar A, Gotsis W, Frishman W. Second-hand tobacco smoke and cardiovascular disease risk: an epidemiological review. *Cardiol Rev* 2013;21:94–100.
- 3 World Health Organization. New brief outlines devastating harms from tobacco use and exposure to second-hand tobacco smoke during pregnancy and throughout childhood - Report calls for protective policies. Geneva; 2021. <https://www.who.int/news/item/16-03-2021-new-brief-outlines-devastating-harms-from-tobacco-use-and-exposure-to-second-hand-tobacco-smoke-during-pregnancy-and-throughout-childhood#:~:text=Second-hand%20smoke%20kills%20around%201.2%20million%20people%20every,to%20try%20smoking%20by%20the%20age%20of%2015> [Accessed 28 Jun 2022].
- 4 McIntire RK, Nelson AA, Macy JT, *et al*. Secondhand smoke exposure and other correlates of susceptibility to smoking: a propensity score matching approach. *Addict Behav* 2015;48:36–43.
- 5 Centers for Disease Control and Prevention. Secondhand smoke, 2022. Atlanta. Available: [https://www.cdc.gov/tobacco/basic\\_information/secondhand\\_smoke/index.htm](https://www.cdc.gov/tobacco/basic_information/secondhand_smoke/index.htm) [Accessed 28 Jun 2022].
- 6 Agaku IT, Odani S, King BA, *et al*. Prevalence and correlates of secondhand smoke exposure in the home and in a vehicle among youth in the United States. *Prev Med* 2019;126:105745.
- 7 Mlinarić M, Kastaun S, Kotz D. Exposure to tobacco smoking in vehicles, indoor, and outdoor settings in Germany: prevalence and associated factors. *Int J Environ Res Public Health* 2022;19:4051.



- 8 World Health Organization. *WHO Framework Convention on Tobacco Control*. Geneva, Switzerland: WHO Document Production Services, 2006.
- 9 Shang C. The effect of smoke-free air law in bars on smoking initiation and relapse among teenagers and young adults. *Int J Environ Res Public Health* 2015;12:504–20.
- 10 Song AV, Dutra LM, Neilands TB, *et al*. Association of smoke-free laws with lower percentages of new and current smokers among adolescents and young adults: an 11-year longitudinal study. *JAMA Pediatr* 2015;169:e152285.
- 11 Nogueira SO, Fu M, Lugo A, *et al*. Non-smokers' and smokers' support for smoke-free legislation in 14 indoor and outdoor settings across 12 European countries. *Environ Res* 2022;204:112224.
- 12 Gruer L, Tursan d'Espaignet E, Haw S, *et al*. Smoke-free legislation: global reach, impact and remaining challenges. *Public Health* 2012;126:227–9.
- 13 Nazar GP, Lee JT, Arora M, *et al*. Socioeconomic inequalities in Secondhand smoke exposure at home and at work in 15 low- and middle-income countries. *Nicotine Tob Res* 2016;18:1230–9.
- 14 Statista. Number of countries by state of smoke-free legislation as of 2020, by income level, 2022. New York. Available: <https://www.statista.com/statistics/449570/number-of-countries-by-strength-of-smoke-free-legislation-worldwide-by-income-level/> [Accessed 28 Jun 2022].
- 15 Satterlund TD, Cassady D, Treiber J, *et al*. Barriers to adopting and implementing local-level tobacco control policies. *J Community Health* 2011;36:616–23.
- 16 Thrasher JF, Boado M, Sebríe EM, *et al*. Smoke-free policies and the social acceptability of smoking in Uruguay and Mexico: findings from the International tobacco control policy evaluation project. *Nicotine Tob Res* 2009;11:591–9.
- 17 Jankowski M, Rees V, Zgliczyński WS, *et al*. Self-reported secondhand smoke exposure following the adoption of a national smoke-free policy in Poland: analysis of serial, cross-sectional, representative surveys, 2009–2019. *BMJ Open* 2020;10:e039918.
- 18 Jassem J, Przewoźniak K, Zatoński W. Tobacco control in Poland—successes and challenges. *Transl Lung Cancer Res* 2014;3:280–5.
- 19 Jankowski M, Pinkas J, Zgliczyński WS, *et al*. Voluntary smoke-free home rules and exposure to secondhand smoke in Poland: a national cross-sectional survey. *Int J Environ Res Public Health* 2020;17:7502.
- 20 Frazer K, Callinan JE, McHugh J, *et al*. Legislative smoking bans for reducing harms from secondhand smoke exposure, smoking prevalence and tobacco consumption. *Cochrane Database Syst Rev* 2016;2:CD005992.
- 21 Chun H-R, Cheon E, Hwang J-E. Systematic review of changed smoking behaviour, smoking cessation and psychological states of smokers according to cigarette type during the COVID-19 pandemic. *BMJ Open* 2022;12:e055179.
- 22 Jankowski M, Ostrowska A, Sierpiński R, *et al*. The prevalence of tobacco, heated tobacco, and e-cigarette use in Poland: a 2022 web-based cross-sectional survey. *Int J Environ Res Public Health* 2022;19:4904.
- 23 Szymański J, Ostrowska A, Pinkas J, *et al*. Awareness of tobacco-related diseases among adults in Poland: a 2022 nationwide cross-sectional survey. *Int J Environ Res Public Health* 2022;19:5702.
- 24 Ngo A, Cheng K-W, Chaloupka FJ, *et al*. The effect of MPOWER scores on cigarette smoking prevalence and consumption. *Prev Med* 2017;105S:S10–14.
- 25 Nationwide Research Panel Ariadna. About the panel. Available: <https://panelariadna.com/> [Accessed 25 Jun 2022].
- 26 Central Statistical Office of the Republic of Poland. National official register of the territorial division of the country. Available: <https://eteryt.stat.gov.pl/eTeryt/english.aspx> [Accessed 25 Jun 2022].
- 27 Fedorowski JJ, Jankowski M, Buchelt B, *et al*. Smoke-free hospitals in Poland – a cross-sectional survey. *Arch Med Sci* 2020.
- 28 La Torre G, Kirch W, Bes-Rastrollo M, *et al*. Tobacco use among medical students in Europe: results of a multicentre study using the global health professions student survey. *Public Health* 2012;126:159–64.
- 29 Okoli CTC, Kodet J. A systematic review of secondhand tobacco smoke exposure and smoking behaviors: smoking status, susceptibility, initiation, dependence, and cessation. *Addict Behav* 2015;47:22–32.
- 30 Tobaqiy M, MacLure A, Thomas D, *et al*. The impact of COVID-19 on smoking behaviours and support for smoke-free zones in Saudi Arabia. *Int J Environ Res Public Health* 2021;18:6927.
- 31 Bar-Zeev Y, Shauly M, Lee H, *et al*. Changes in smoking behaviour and Home-Smoking rules during the initial COVID-19 Lockdown period in Israel. *Int J Environ Res Public Health* 2021;18:1931.
- 32 Lavery AA, Hone T, Vamos EP, *et al*. Impact of banning smoking in cars with children on exposure to second-hand smoke: a natural experiment in England and Scotland. *Thorax* 2020;75:345–7.
- 33 Lavery AA, Filippidis FT, Been JV, *et al*. Smoke-free vehicles: impact of legislation on child smoke exposure across three countries. *Eur Respir J* 2021;58:2004600.
- 34 Ng C, Smyth AR. Smoking ban in cars protects children, but is vaping 'The Elephant in the Car'? *Thorax* 2020;75:297.
- 35 Ravara SB, Castelo-Branco M, Aguiar P, *et al*. Compliance and enforcement of a partial smoking ban in Lisbon taxis: an exploratory cross-sectional study. *BMC Public Health* 2013;13:134.
- 36 Raouf SA, Agaku IT, Vardavas CI. A systematic review of secondhand smoke exposure in a car: attributable changes in atmospheric and biological markers. *Chron Respir Dis* 2015;12:120–31.