

# A 2024 NATIONWIDE CROSS-SECTIONAL SURVEY TO ASSESS THE PREVALENCE OF CIGARETTE SMOKING, E-CIGARETTE USE AND HEATED TOBACCO USE IN POLAND

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## Abstract

**Objectives:** Monitoring tobacco use is one of the most important tobacco control interventions recommended by the World Health Organization. This study aimed to assess the prevalence of cigarette smoking, e-cigarette use, and heated tobacco use in a nationwide sample of adults in Poland, as well as to identify factors associated with smoking, e-cigarette use, and heated tobacco use. **Material and Methods:** This nationwide cross-sectional survey was carried out in February 2–4, 2024 using the computer-assisted web interviewing method. The study questionnaire included 17 closed questions on smoking, e-cigarette use, and heated tobacco use. A sample of 1080 adults was selected using a non-probability quota sampling method. **Results:** Data were collected from 1080 adults, age  $M \pm SD$   $48.4 \pm 15.5$  years, 53% females. Past 30-day smoking was declared by 30.4% of adults in Poland, including 24.5% of daily smokers. Ever e-cigarette use was declared by 33% of respondents, and 20.6% had ever tried heated tobacco. Past 30-day e-cigarette use was declared by 15.2% of adults, wherein 5.9% were daily e-cigarette users. Past 30-day heated tobacco use was declared by 10.9% of respondents, wherein 4.9% were daily heated tobacco users. One-tenth of adults were dual users (cigarette and e-cigarette or heated tobacco), and 6.5% were past 30-day triple users. Age 40–59 years, having less than higher education, and bad economic status were significantly associated with daily smoking ( $p < 0.05$ ). Age 18–39 years, having less than higher education, and active occupational status (employment/self-employment) were associated with daily e-cigarette use ( $p < 0.05$ ). Age 18–39 years and active occupational status were associated with daily heated tobacco use ( $p < 0.05$ ). **Conclusions:** This study provides comprehensive epidemiological data on the current prevalence of smoking, e-cigarette use, and heated tobacco use. The introduction of e-cigarettes and heated tobacco products evoked changes in social behaviors related to nicotine use. *Int J Occup Med Environ Health.* 2024;37(3):271–86

## Key words:

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## INTRODUCTION

Monitoring tobacco use is one of the tobacco control interventions recommended by the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) [1]. Nationally representative data on tobacco use are essential to implement and evaluate the effectiveness of national tobacco control policies [2,3]. Smoking prevalence is assessed as a part of international studies like the Global Adult Tobacco Survey (GATS), the European Union (EU) Eurobarometer as well as national studies [4,5].

Poland is an example of a European country that has made significant progress in tobacco control over the past 50 years, including a reduction in smoking prevalence and exposure to secondhand smoke in public venues [6,7]. Between the 1970s and 2014, the prevalence of smoking in Poland decreased from 73% to 28% among males and from 30% to 19% among females [6]. Between 2009 and 2019, secondhand smoke exposure in the workplace decreased from 25.4% to 6.7% and from 45.7% to 11.7% in public transport stops and facilities [7]. Tobacco use in Poland still poses a significant public health issue, with 82 000 tobacco-related deaths reported annually [8].

In the last decade, new forms of nicotine-containing products like electronic cigarettes (e-cigarettes) and heated tobacco products (like IQOS, glo, and Ploom) have gained popularity [9,10]. E-cigarettes and heated tobacco are marketed as alternatives to combustible tobacco products (cigarettes) [10,11]. The health risks of e-cigarettes and heated tobacco products are unknown, and the data on their effectiveness in quitting smoking is inconclusive [12–14]. The widespread availability of new forms of nicotine-containing products means that tobacco monitoring interventions should also include monitoring of e-cigarettes and heated tobacco use [9,10,12]. Scientific data also indicate the phenomenon of switching from cigarettes to e-cigarettes or heated tobacco, as well as the dual use of cigarettes and e-cigarettes or heated tobacco, which makes it difficult to assess the effectiveness of national tobacco control policies [13–15].

A 2022 nationwide study on “Poles’ attitudes towards smoking” showed that 28.8% of adults in Poland were daily smokers, 4.8% used e-cigarettes daily, and 4% were daily heated tobacco users [16]. Over the last 2 years in Poland, many events have occurred that may have influenced the epidemiology of nicotine product use, including the end of the COVID-19 pandemic and related preventive measures, public debate on the ban of disposable e-cigarettes and the launch of a new heated tobacco product (Ploom) [17]. Up-to-date data on the prevalence of smoking, e-cigarette use, and heated tobacco use may inform healthcare professionals and policymakers on further needs related to strengthening national tobacco control policy. This study aimed to assess the prevalence of cigarette smoking, e-cigarette use, and heated tobacco use in a nationwide sample of adults in Poland, as well as to identify factors associated with smoking, e-cigarette use, and heated tobacco use.

## MATERIAL AND METHODS

### Study design

This nationwide cross-sectional survey was carried out in February 2–4, 2024 using the computer-assisted web interviewing (CAWI) method. The study questionnaire included 17 closed questions on the use of different nicotine-containing products. Data were collected by a specialized public opinion research company – Nationwide Research Panel Ariadna, Warsaw, Poland [18] – on behalf of the authors who provided the scientific background for this study. This is the next wave of the nationwide study “Poles’ attitudes towards smoking” carried out every 2 years by the School of Public Health, Centre for Medical Postgraduate Education, Warsaw, Poland, as a part of public health interventions on monitoring tobacco use [16].

### Population

A sample of 1080 adults was selected from the database of the public opinion research company, which includes

>100 000 registered and verified individuals from all over Poland. A non-probability quota sampling was used. The following demographic variables were used for sampling: gender, age, and place of residence. Sampling followed the demographic structure of the Polish population published by Statistics Poland [19].

### Measures

The study questionnaire was based on the Global Adult Tobacco Survey (GATS) [4] and previous waves of the study “Poles’ attitudes towards smoking” [16]. Questions addressed the prevalence of nicotine-containing products use (smoking tobacco, e-cigarettes, heated tobacco products) and sociodemographic characteristics (gender, age, educational level, marital status, having children, place of residence, occupational activity, and self-declared economic status).

#### Tobacco smoking

The following questions on smoking were addressed: “Have you ever smoked at least 100 cigarettes (or a similar amount of other tobacco products, e.g., pipes, cigars, cigarillos) in your lifetime?”, “Have you smoked tobacco in the past 30 days?” and “During the last 6 months, have you smoked tobacco daily?”. Respondents who smoked at least 100 cigarettes (or other tobacco products) and smoked tobacco in the past 30 days were classified as “current smokers.” Those who smoked tobacco daily in the past 6 months were classified as “daily smokers,” and those who did not smoke daily in the past 6 months were classified as “occasional smokers.” Smokers were also asked about the most common types of tobacco products they smoked and the number of tobacco products consumed per day.

#### E-cigarette use

Respondents were asked about lifetime e-cigarette use with the following question: “Have you ever used e-cigarettes (at least once)? (yes/no).” Current e-cigarette use

was based on the following question “Have you used an e-cigarette in the past 30 days?”, with 3 possible answers: “yes, daily,” “yes, occasionally,” “no.”

#### Heated tobacco use

Respondents were asked about lifetime heated tobacco use with the following question: “Have you ever used heated tobacco products (at least once)? (yes/no).” Current e-cigarette use was based on the following question “Have you used heated tobacco products in the past 30 days?”, with 3 possible answers: “yes, daily,” “yes, occasionally,” “no.”

Dual users were those who smoked cigarettes in the past 30 days and used e-cigarettes or heated tobacco in the past 30 days. Tripple users were those who smoked cigarettes, used e-cigarettes, and heated tobacco in the past 30 days.

#### Type and the number of tobacco products smoked

Respondents were asked about the type and number of tobacco products smoked with the following question: “What form of tobacco do you smoke?” with the following possible answers: “regular (packed) cigarettes,” “menthol cigarettes,” “slim cigarettes,” “hand-rolled cigarettes,” “cigars,” “cigarillos,” “pipe,” “shisha.” Respondents who smoked in the past 30-days were asked to answer yes/no to each of 8 different tobacco products. Moreover, respondents were asked to self-declare the number of tobacco products smoked per day, in reference to the declared tobacco products they smoked.

### Ethics

Participation in this study was voluntary and anonymous. All participants declared informed consent. The procedures followed the guidelines of the Helsinki Declaration. The study protocol was approved by the Ethical Committee at the Centre of Postgraduate Medical Education in Warsaw (decision number 403/2023 as of August 23, 2023).

## Statistics

Data were analyzed with IBM SPSS Statistics 29. Frequencies and proportions were used to present the distribution of categorical variables. Cross-tabulations and  $\chi^2$  tests were used to compare categorical variables. The Shapiro-Wilk test was used to assess the distributions of continuous variables. Continuous variables were presented with mean (M) and standard deviation (SD). The significance of the differences between continuous variables was assessed using the independent samples Student's t-test or, if the assumptions were not met, the Mann-Whitney U test.

Logistic regression analyses were carried out to identify factors associated with tobacco smoking, e-cigarette use, and heated tobacco use. Gender, age, educational level, marital status, having children, place of residence, occupational activity, and self-declared economic status were considered independent variables. Smoking: 1) past 30-day smoking and 2) daily smoking; e-cigarette use: 3) ever e-cigarette use, 4) past 30-day e-cigarette use; heated tobacco use: 5) ever heated tobacco use, 6) past 30-day heated tobacco use were considered as dependent variables in 6 different models. In bivariable logistic regression analyses, all independent variables were considered separately. Variables significantly associated with tobacco/e-cigarette use in bivariable models ( $p < 0.05$ ) were included in multivariable logistic regression models. The strength of the association was measured by the odds ratio (OR) and 95% confidence intervals (CI). The statistical significance level was  $p < 0.05$ .

## RESULTS

Data were collected from 1080 adults, with age  $M \pm SD$   $48.4 \pm 15.5$  years, 53% females. The demographic characteristics of the study population is presented in Table 1. Past 30-day smoking was declared by 30.4% of adults in Poland, including 24.5% daily smokers and 5.8% occasional smokers. Ever e-cigarette use was declared by 33%

of respondents, and 20.6% had ever tried heated tobacco products (Table 1). Past 30-day e-cigarette use was declared by 15.2% of adults in Poland, wherein 5.9% were daily e-cigarette users. Past 30-day heated tobacco use was declared by 10.9% of respondents, wherein 4.9% were daily heated tobacco users. Among those who used nicotine-containing products, 9.9% used cigarettes and e-cigarettes in the past 30-days days, 9.1% used cigarettes and heated tobacco, and 7.8% used e-cigarettes and heated tobacco in the past 30 days (Table 1). Past 30-day triple use was declared by 6.5% of respondents.

### Smoking habits among adults in Poland

Among adults in Poland ( $N = 1080$ ), 23.4% smoked regular (packed) cigarettes, 7.8% smoked menthol cigarettes, 11.5% smoked slim cigarettes, 1.9% smoked cigars, 4% smoked cigarillos, 2.9% used pipes, and 1.9% used shisha. Among smokers ( $N = 328$ ) in Poland, females more often smoked menthol ( $p = 0.002$ ) or slim cigarettes ( $p < 0.001$ ), while males more often smoked hand-rolled cigarettes ( $p < 0.001$ ), cigars ( $p = 0.01$ ), and pipe ( $p = 0.02$ ) (Table 2). The number of regular cigarettes smoked per day was  $M \pm SD$   $11.3 \pm 7.9$ , wherein the daily number of cigarettes smoked by males was significantly higher ( $p = 0.03$ ) than by females (Table 2).

### Factors associated with tobacco smoking

Age 40–49 years (OR 1.79, 95% CI: 1.22–2.64,  $p < 0.01$ ) or 50–59 years (OR 1.61, 95% CI: 1.09–2.36,  $p < 0.05$ ), having less than higher education (OR 1.47, 95% CI: 1.12–1.94,  $p < 0.01$ ), and living in city between 20 000–99 999 residents (OR 1.67, 95% CI: 1.02–2.73,  $p < 0.05$ ) or city between 100 000–499 999 residents (OR 1.76, 95% CI: 1.07–2.92,  $p < 0.05$ ) were significantly associated with past 30-day smoking (Table 3). Age 40–49 (OR 1.60; 95% CI: 1.07–2.41,  $p < 0.05$ ) or 50–59 years (OR 1.63, 95% CI: 1.10–2.43,  $p < 0.05$ ), having less than higher education (OR 1.67, 95% CI: 1.24–2.23,  $p < 0.001$ ), and bad

**Table 1.** Characteristics of the study population and the prevalence of smoking, vaping, and heated tobacco use, Poland, February 2024

Variable	Participants (N = 1080) [n (%)]
Gender	
female	572 (53.0)
male	508 (47.0)
Age	
18–29 years	140 (13.0)
30–39 years	211 (19.5)
40–49 years	201 (18.6)
50–59 years	203 (18.8)
≥60 years	325 (30.1)
Education	
primary	18 (1.7)
vocational	132 (12.2)
secondary	461 (42.7)
higher	469 (43.4)
Marital status	
single	214 (19.8)
married	619 (57.3)
informal relationship	147 (13.6)
divorced	52 (4.8)
widowed	48 (4.5)
Having children	
yes	732 (67.8)
no	348 (32.2)
Place of residence	
rural	416 (38.5)
city	
<20 000 residents	137 (12.7)
20 000–99 999 residents	211 (19.5)
100 000–499 999 residents	187 (17.3)
≥500 000 residents	129 (12.0)
Occupational activity	
employed/self-employed	656 (60.7)
passive (unemployed or retired)	424 (39.3)

Variable	Participants (N = 1080) [n (%)]
Self-declared economic status	
good	330 (30.6)
moderate	606 (56.1)
bad	144 (13.3)
Tobacco smoking	
smokers (past 30-day smoking)	328 (30.4)
daily (past 30-day) smokers	265 (24.5)
occasional smokers	63 (5.8)
E-cigarette use	
ever e-cigarette use	356 (33.0)
current (past 30-day)	
e-cigarette use	164 (15.2)
daily e-cigarette use	64 (5.9)
Heated tobacco use	
ever heated tobacco use	223 (20.6)
current (past 30-day)	
heated tobacco use	118 (10.9)
daily heated tobacco use	53 (4.9)
Dual use (past 30-day)	
cigarette and e-cigarette	107 (9.9)
cigarette and heated tobacco	98 (9.1)
e-cigarette and heated tobacco	84 (7.8)
Triple use (past 30-day)	
cigarette, e-cigarette and heated tobacco	70 (6.5)

economic status (OR 1.59, 95% CI: 1.02–2.50,  $p < 0.05$ ) were significantly associated with daily smoking (Table 3).

#### Factors associated with e-cigarette use

Age <60 years ( $p < 0.001$ ), having less than higher education (OR 1.52, 95% CI: 1.15–2.01,  $p < 0.01$ ), and being married (OR 1.49, 95% CI: 1.01–2.18,  $p < 0.05$ ) or informal relationship (OR 2.06, 95% CI: 1.30–3.27,  $p < 0.01$ ) were significantly associated with ever e-cigarette use (Table 4). Age <50 years ( $p < 0.05$ ), having less than higher education (OR 1.86, 95% CI: 1.29–2.68,  $p < 0.001$ ) and active occu-

**Table 2.** The most common types of tobacco products smoked by adults in Poland, February 2024

Tobacco product	Participants (N = 328)			p
	total	females (N = 163)	males (N = 165)	
The most common type [n (%)]				
regular (packed) cigarettes	253 (77.1)	121 (74.2)	132 (80.0)	0.2
menthol cigarettes	84 (25.6)	54 (33.1)	30 (18.2)	<b>0.002</b>
slim cigarettes	124 (37.8)	78 (47.9)	46 (27.9)	<b>&lt;0.001</b>
hand-rolled cigarettes	86 (26.2)	29 (17.8)	57 (34.5)	<b>&lt;0.001</b>
cigars	21 (6.4)	5 (3.1)	16 (9.7)	<b>0.01</b>
cigarillos	43 (13.1)	16 (9.8)	27 (16.4)	0.08
pipe	31 (9.5)	9 (5.5)	22 (13.3)	<b>0.02</b>
shisha	21 (6.4)	10 (6.1)	11 (6.7)	0.8
Smoked daily [n]				
regular (packed) cigarettes	253	121	132	<b>0.03</b>
M±SD	11.3±7.9	10.3±8.0	12.1±7.8	
min.–max	1–40	1–40	1–40	
Me	10	10	10	
menthol cigarettes	84	54	30	0.7
M±SD	6.1±7.4	5.9±7.0	6.4±8.2	
min.–max	1–40	1–40	1–33	
Me	4	4	4	
slim cigarettes	124	78	46	0.5
M±SD	7.92±7.5	8.5±8.0	7.0±6.6	
min.–max	1–40	1–40	1–30	
Me	5	5	5	
hand-rolled cigarettes	86	29	57	0.3
M±SD	8.8±8.1	7.8±8.3	9.3±8.0	
min.–max	1–30	1–30	1–30	
Me	5	5	8	
cigars	21	5	16	0.8
M±SD	2.5±2.5	2.0±1.0	2.7±2.8	
min.–max	1–10	1–3	1–10	
Me	1	2	1	
cigarillos	43	16	27	0.6
M±SD	3.0±4.7	1.9±1.1	3.7±5.8	
min.–max	1–30	1–4	1–30	
Me	1	2	1	

Bolded values are statistically significant.

**Table 3.** Factors associated with tobacco smoking, Poland, February 2024

Variable	Smoking					
	past 30-day			daily		
	participants answering yes [n (%)]	p	logistic regression (OR (95% CI))	participants answering yes [n (%)]	p	logistic regression (OR (95% CI))
Gender						
female	163 (28.5)	0.2	ref.	129 (22.6)	0.1	ref.
male	165 (32.5)		1.21 (0.93–1.57)	136 (26.8)		1.26 (0.95–1.66)
Age						
18–29 years	36 (25.7)	<b>0.02</b>	1.01 (0.64–1.59)	25 (17.9)	<b>0.004</b>	0.76 (0.46–1.27)
30–39 years	63 (29.9)		1.24 (0.84–1.83)	43 (20.4)		0.90 (0.59–1.38)
40–49 years	73 (36.3)		1.67 (1.14–2.43)**	60 (29.9)		1.50 (1.01–2.23)*
50–59 years	73 (36.0)		1.64 (1.12–2.39)**	65 (32.0)		1.67 (1.12–2.46)*
≥60 years	83 (25.5)		ref.	72 (22.2)		ref.
Education						
higher	122 (26.0)	<b>0.006</b>	ref.	89 (19.0)	<b>&lt;0.001</b>	ref.
less than higher	206 (33.7)		1.45 (1.11–1.89)**	176 (28.8)		1.73 (1.29–2.31)***
Marital status						
single	66 (30.8)	0.3	ref.	50 (23.4)	0.2	ref.
married	174 (28.1)		0.88 (0.63–1.23)	145 (23.4)		1.00 (0.70–1.45)
informal relationship	50 (34.0)		1.16 (0.74–1.81)	36 (24.5)		1.06 (0.65–1.74)
divorced	20 (38.5)		1.40 (0.75–2.63)	19 (36.5)		1.89 (0.99–3.61)
widowed	18 (37.5)		1.35 (0.70–2.58)	15 (31.3)		1.49 (0.75–2.97)
Having children						
yes	231 (31.6)	0.2	1.19 (0.90–1.58)	193 (26.4)	<b>0.04</b>	1.37 (1.01–1.87)*
no	97 (27.9)		ref.	72 (20.7)		ref.
Place of residence						
rural	125 (30.0)	<b>0.04</b>	1.30 (0.83–2.05)	104 (25.0)	<b>0.01</b>	1.32 (0.81–2.14)

**Table 3.** Factors associated with tobacco smoking, Poland, February 2024 – cont.

Variable	Smoking							
	past 30-day				daily			
	participants answering yes [n (%)]	p	bivariable	logistic regression (OR (95% CI))	participants answering yes [n (%)]	p	bivariable	logistic regression (OR (95% CI))
Place of residence – cont.								
city								
<20 000 residents	27 (19.7)		0.74 (0.42–1.33)	0.74 (0.41–1.33)	20 (14.6)		0.68 (0.36–1.29)	
20 000–99 999 residents	76 (36.0)		1.71 (1.05–2.78)*	1.67 (1.02–2.73)*	60 (28.4)		1.57 (0.93–2.66)	
100 000–499 999 residents	68 (36.4)		1.73 (1.05–2.85)*	1.76 (1.07–2.92)*	55 (29.4)		1.65 (0.97–2.81)	
≥500 000 residents	32 (24.8)		ref.	ref.	26 (20.2)		ref.	
Occupational activity								
employed/self-employed	212 (32.3)	0.08	1.27 (0.97–1.66)		171 (26.1)	0.1	1.24 (0.93–1.65)	
passive (unemployed or retired)	116 (27.4)		ref.		94 (22.2)		ref.	
Self-declared economic status								
good	95 (28.8)	0.1	ref.		69 (20.9)	<b>0.02</b>	ref.	ref.
moderate	179 (29.5)		1.04 (0.77–1.39)		149 (24.6)		1.23 (0.89–1.70)	1.13 (0.81–1.57)
bad	54 (37.5)		1.48 (0.98–2.24)		47 (32.6)		1.83 (1.18–2.84)**	1.59 (1.02–2.50)*

Bolded values are statistically significant.

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.



pational (employed or self-employed) status (OR 1.66, 95% CI: 1.08–2.54,  $p < 0.05$ ) were significantly associated with past 30-day e-cigarette use (Table 4).

#### Factors associated with heated tobacco use

Age  $< 50$  years ( $p < 0.05$ ), being in an informal relationship (OR 1.86, 95% CI: 1.12–3.09,  $p < 0.05$ ), living in a city between 100 000–499 999 residents (OR 1.63, 95% CI: 1.06–2.50,  $p < 0.05$ ), and active occupational (employed or self-employed) status (OR 1.70, 95% CI: 1.16–2.51,  $p < 0.01$ ) were significantly associated with ever heated tobacco use (Table 5). Age  $< 40$  years ( $p < 0.05$ ) and active occupational (employed or self-employed) status (OR 2.66, 95% CI: 1.53–4.63,  $p < 0.001$ ) were significantly associated with past 30-day heated tobacco use (Table 5).

#### DISCUSSION

This study provides nationwide, up-to-date data on the prevalence of cigarette smoking, e-cigarette use, and heated tobacco use in Poland in 2024. This study revealed a high prevalence of past 30-day smoking (30.4%), e-cigarette use (15.2%), and heated tobacco use (10.9%). This study showed that almost one-tenth of adults in Poland were dual users in the past 30 days, and 6.5% were triple users, which suggests that the introduction of e-cigarettes and heated tobacco products evoked change in patterns of nicotine-containing product use among smokers in Poland. Moreover, findings from the multivariable logistic regression pointed out factors significantly associated with public attitudes towards past 30-day smoking, e-cigarette use, and heated tobacco use.

This study is the second wave of the study “Poles’ attitudes towards smoking” carried out using the same methodology and CAWI technique, so direct comparisons between 2022 and 2024 are possible [16]. In wave 2022, smoking prevalence among adults in Poland was 28.8%, wherein 24.6% were daily smokers [16]. Data from 2024 (30.4% of adults declared smoking) indicate the rise in

smoking prevalence (past 30 days) in Poland [16]. However, the prevalence of daily smoking remains comparable to data from 2022 (24.5% in 2024 vs. 24.6% in 2022) [16]. Regular (packed) cigarettes remained the most common combustible tobacco product. The average number of cigarettes smoked per day in 2024 ( $M \pm SD$  11.3  $\pm$  7.9 cigarettes) was comparable to those observed in 2022 ( $M \pm SD$  11.9  $\pm$  11.5 cigarettes) [16]. Females more often smoked menthol cigarettes and slim cigarettes, which is in line with the scientific data on marketing strategies of the tobacco industry, that target slim and menthol cigarettes to females [20]. Despite the ban on the sale of menthol cigarettes, 7.8% of adults in Poland still smoke those cigarettes, and the source of supply should be identified [21]. Over one-quarter of smokers prepared hand-rolled cigarettes, which may result from lower taxation of rolling tobacco than cigarettes. Data on the most common types of tobacco products smoked by adults in Poland suggest, that smokers use different types of combustible tobacco products (e.g., regular cigarettes and slim cigarettes or menthol ones).

Age 40–59 years, lack of higher education, and living in small and medium-sized cities were significantly associated with past 30-day smoking. This finding is in line with the previously published data on socioeconomic disparities in tobacco use in Poland [22]. Moreover, age 40–59 years, lack of higher education, and bad economic status were associated with daily smoking. In 2022, lack of higher education was also significantly associated with daily smoking [16], but also age 50–59 years and having children were associated with daily smoking. It can be hypothesized that younger adults ( $< 40$  years) are better educated on lifestyle and health hazards, so in this study, adults aged 40–49 years were more likely to smoke daily mostly due to changes in the lifestyle of younger adults, rather than increase in smoking prevalence in this age group (40–49 years).

There were no gender differences in the prevalence of smoking as well as ever and current e-cigarette or heated

**Table 4.** Factors associated with e-cigarette use, Poland, February 2024

Variable	E-cigarette use							
	ever				past 30-day			
	participants [n (%)]	p	logistic regression (OR (95% CI))	participants [n (%)]	p	bivariable	logistic regression (OR (95% CI))	multivariable
Gender								
female	194 (33.9)	0.5	1.10 (0.85–1.41)	89 (15.6)	0.7	1.06 (0.76–1.49)		
male	162 (31.9)		ref.	75 (14.8)		ref.		
Age								
18–29 years	83 (59.3)	<0.001	6.43 (4.15–9.97)***	43 (30.7)	<0.001	5.82 (3.34–10.2)***	4.68 (2.61–8.39)***	
30–39 years	80 (37.9)		2.70 (1.82–4.00)***	40 (19.0)		3.07 (1.78–5.30)***	2.56 (1.41–4.64)**	
40–49 years	69 (34.3)		2.31 (1.54–3.46)***	32 (15.9)		2.49 (1.41–4.39)**	1.99 (1.07–3.68)*	
50–59 years	64 (31.5)		2.03 (1.35–3.06)***	26 (12.8)		1.93 (1.07–3.48)*	1.50 (0.81–2.80)	
≥60 years	60 (18.5)		ref.	23 (7.1)		ref.	ref.	
Education								
higher	135 (28.8)	0.01	ref.	55 (11.7)	0.006	ref.	ref.	
less than higher	221 (36.2)		1.40 (1.08–1.82)**	109 (17.8)		1.63 (1.15–2.32)**	1.86 (1.29–2.68)***	
Marital status								
single	73 (34.1)	0.002	ref.	33 (15.4)	0.04	ref.	ref.	
married	184 (29.7)		0.82 (0.59–1.14)	87 (14.1)		0.90 (0.58–1.39)		
informal relationship	69 (46.9)		1.71 (1.11–2.63)*	33 (22.4)		1.59 (0.93–2.72)		
divorced	15 (28.8)		0.78 (0.40–1.52)	3 (5.8)		0.34 (0.10–1.14)		
widowed	15 (31.3)		0.88 (0.45–1.72)	8 (16.7)		1.10 (0.47–2.55)		
Having children								
yes	229 (31.3)	0.1	ref.	105 (14.3)	0.3	ref.		
no	127 (36.5)		1.26 (0.97–1.65)	59 (17.0)		1.22 (0.86–1.73)		
Place of residence								
rural	128 (30.8)	0.2	0.83 (0.55–1.26)	56 (13.5)	0.1	0.96 (0.54–1.70)		

Place of residence – cont.							
city							
<20 000 residents	38 (27.7)	0.72 (0.43–1.21)	15 (10.9)	0.76 (0.37–1.58)			
20 000–99 999 residents	72 (34.1)	0.97 (0.61–1.53)	36 (17.1)	1.27 (0.69–2.34)			
100 000–499 999 residents	73 (39.0)	1.20 (0.75–1.91)	39 (20.9)	1.63 (0.88–2.99)			
≥500 000 residents	45 (34.9)	ref.	18 (14.0)	ref.			
Occupational activity							
employed/self-employed	248 (37.8)	<b>&lt;0.001</b>	121 (18.4)	<b>&lt;0.001</b>	2.00 (1.38–2.91) <sup>***</sup>	1.66 (1.08–2.54) <sup>*</sup>	ref.
passive (unemployed or retired)	108 (25.5)	ref.	43 (10.1)	ref.			
Self-declared economic status							
good	114 (34.5)	0.2	55 (16.7)	<b>0.04</b>			
moderate	187 (30.9)	0.85 (0.64–1.12)	79 (13.0)		0.75 (0.52–1.09)		
bad	55 (38.2)	1.17 (0.78–1.76)	30 (20.8)		1.32 (0.80–2.16)		

Bolded values are statistically significant.

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

tobacco use. This finding underlines the lack of gender gaps in tobacco consumption, which were reported previously in Poland, and points out to strengthen tobacco control measures targeted to females [23].

Findings from this study showed that one-third of adults in Poland had ever tried e-cigarettes. This finding suggests that e-cigarettes are perceived as modern electronic devices with flavoured vapor that encourages adults (also non-smokers) to try them [24]. Respondents who were married or in informal relationships were more likely to try e-cigarettes, which suggests that couples share e-cigarettes (to try for the first time or occasional use). In previous studies, a high prevalence of ever e-cigarette use was reported among adolescents aged 13–19 years (52%) [25] and university students in Poland (45%) [26]. In this study, younger age was the most important factor associated with ever e-cigarette use (59% of adults aged 18–29 years had ever tried an e-cigarette), so such a high prevalence of ever e-cigarette use reported in this study is mostly attributed to the very high prevalence of ever e-cigarette use among the youngest adults. In this study, a high prevalence of past 30-day e-cigarette use was reported (15.2% of adults), whereas daily e-cigarette use was reported by 5.9% of adults. This finding suggests that most of the past 30-day e-cigarette users are occasional users, and e-cigarette device sharing or use of disposable e-cigarettes is a common behavior among past 30-day e-cigarette users [27]. Compared to 2022 (4.8% reported daily e-cigarette use), a rise in daily e-cigarette use was observed [16]. Younger age, lack of higher education, and being occupationally active were the most important factors associated with past 30-day e-cigarette use. These findings point out a need to implement public health interventions on e-cigarettes in companies, as a part of workplace health promotion programs [28,29]. Heated tobacco products have been available in Poland since April 2017 [30], and within 6 years of market launch, >20% of adults in Poland had ever tried heated tobacco

**Table 5.** Factors associated with heated tobacco use, Poland, February 2024

Variable	Heated tobacco use					
	ever			past 30-day		
	participants [n (%)]	p	logistic regression (OR (95%CI)) bivariable	participants [n (%)]	p	logistic regression (OR (95%CI)) bivariable
Gender						
female	117 (20.5)	0.8	0.98 (0.73–1.31)	55 (9.6)	0.1	0.75 (0.51–1.10)
male	106 (20.9)		ref.	63 (12.4)		ref.
Age						
18–29 years	48 (34.3)	<b>&lt;0.001</b>	4.62 (2.80–7.63)***	20 (14.3)	<b>&lt;0.001</b>	4.00 (1.93–8.30)***
30–39 years	64 (30.3)		3.85 (2.42–6.13)***	38 (18.0)		5.27 (2.73–10.17)***
40–49 years	44 (21.9)		2.48 (1.52–4.05)***	25 (12.4)		3.41 (1.70–6.83)***
50–59 years	34 (16.7)		1.78 (1.06–2.98)*	22 (10.8)		2.92 (1.44–5.93)**
≥60 years	33 (10.2)		ref.	13 (4.0)		ref.
Education						
higher	104 (22.2)	0.3	1.18 (0.88–1.58)	58 (12.4)	0.2	1.30 (0.88–1.90)
less than higher	119 (19.5)		ref.	60 (9.8)		ref.
Marital status						
single	43 (20.1)	<b>0.01</b>	ref.	18 (8.4)	0.7	ref.
married	115 (18.6)		0.91 (0.61–1.34)	70 (11.3)		1.39 (0.81–2.39)
informal relationship	46 (31.3)		1.81 (1.12–2.94)*	19 (12.9)		1.62 (0.82–3.20)
divorced	8 (15.4)		0.72 (0.32–1.65)	5 (9.6)		1.16 (0.41–3.28)
widowed	11 (22.9)		1.18 (0.56–2.51)	6 (12.5)		1.56 (0.58–4.15)
Having children						
yes	150 (20.5)	0.9	0.97 (0.71–1.33)	87 (11.9)	0.1	1.38 (0.90–2.12)
no	73 (21.0)		ref.	31 (8.9)		ref.
Place of residence						
rural	76 (18.3)	<b>0.04</b>	ref.	43 (10.3)	0.2	ref.

Place of residence – cont.									
city									
<20 000 residents	21 (15.3)	0.81 (0.48–1.37)	0.84 (0.49–1.44)	8 (5.8)	0.54 (0.25–1.17)				
20 000–99 999 residents	43 (20.4)	1.15 (0.75–1.74)	1.13 (0.73–1.74)	27 (12.8)	1.27 (0.76–2.13)				
100 000–499 999 residents	49 (26.2)	1.59 (1.05–2.39)*	1.63 (1.06–2.50)*	25 (13.4)	1.34 (0.79–2.27)				
≥500 000 residents	34 (26.4)	1.60 (1.01–2.55)*	1.56 (0.96–2.53)	15 (11.6)	1.14 (0.61–2.13)				
Occupational activity									
employed/self-employed	170 (25.9)	<b>&lt;0.001</b>	1.70 (1.15–2.51)**	99 (15.1)	3.79 (2.28–6.29)***	<b>&lt;0.001</b>	2.66 (1.53–4.63)***		
passive (unemployed or retired)	53 (12.5)	ref.	ref.	19 (4.5)	ref.	ref.	ref.		
Self-declared economic status									
good	74 (22.4)	0.4	0.97 (0.61–1.55)	40 (12.1)	0.86 (0.48–1.52)	0.2			
moderate	116 (19.1)		0.80 (0.51–1.23)	58 (9.6)	0.66 (0.38–1.13)				
bad	33 (22.9)		ref.	20 (13.9)	ref.				

Bolded values are statistically significant.

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

products. This observation points out an urgent need to regulate the marketing of heated tobacco products (including heated tobacco device brands and tobacco stick brands), especially point-of-sale advertising and marketing in shopping malls, where these products are easily accessible to non-smokers [30,31]. Between 2022 and 2024, the prevalence of daily heated tobacco use among adults in Poland increased from 4% to 4.9% [16]. Age 18–39 years and active occupational status were the most important factors associated with daily heated tobacco use, which suggests that heated tobacco products are marketed to young, occupationally active adults [30,31].

An important finding of this study is the fact that almost one-tenth of adults in Poland are dual users, and 6.5% are triple users, which confirms that the introduction of e-cigarettes and heated tobacco products evoked significant changes in behaviors related to nicotine consumption in Poland. Previously, tobacco control measures were mostly targeted at monitoring combustible tobacco use [1,2], but the relatively high prevalence of dual use among adults in Poland suggests that public health authorities should include 3 types of nicotine-containing products (cigarettes, e-cigarettes, and heated tobacco) during the tobacco monitoring and prevention measures.

### Practical implications

This epidemiological study on the prevalence of cigarette smoking, e-cigarette use, and heated tobacco use in Poland provides data that may be used to monitor the effectiveness of tobacco control at the national level. Moreover, these data may be used for these epidemiological international comparisons. This study showed that novel nicotine-containing products like e-cigarettes and heated tobacco are gaining popularity, and the percentage of ever users is rapidly increasing. Dual use of different nicotine-containing products is a new, common behavior among smokers, as one-third of past 30-day smokers also used e-cigarettes or heated tobacco. Moreover, employed or self-employed

individuals were at higher risk of past 30-day e-cigarette or heated tobacco use, which underlines the need to implement tobacco control policies in the workplaces (especially education and smoking cessation) and promote nicotine-free workplaces.

### Limitations

This study has several limitations related to cross-sectional design. The CAWI method was used, so individuals without Internet access were not included in the study population. Despite the use of well-known questions on monitoring tobacco/nicotine use (past 30-day use), there were no interactions with respondents and there is a risk of recall bias. Moreover, smoking status was self-reported without biochemical tests (e.g., saliva cotinine levels) [32].

### CONCLUSIONS

This study provides comprehensive epidemiological data on the current prevalence of smoking, e-cigarette use, and heated tobacco use. This study revealed that the introduction of e-cigarettes and heated tobacco products evoked changes in social behaviors related to nicotine use. A high prevalence of ever e-cigarette or heated tobacco use was observed. Active occupational status was significantly associated with past 30-day e-cigarette and heated tobacco use, which indicates the role of the workplace in tobacco prevention and cessation.

### Author contributions

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