

How widespread is electronic cigarette use in outdoor settings? A field check from the TackSHS project in 11 European countries

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ABSTRACT

Exposure to secondhand aerosol from electronic cigarettes (e-cigarettes) may pose harms to bystanders, but they are used in many indoor settings. Less evidence exists on e-cigarette use in outdoor settings. This study aims to assess the use of e-cigarettes in outdoor settings in Europe. A cross-sectional study was conducted at the entrances of primary schools (N=200), children's playgrounds (N=200), and outdoor hospitality venues (N=220) during 2017-2018 in major cities of 11 European countries. We performed 30-minute observations and recorded e-cigarette use at three-time points: at 0 minutes, 15 minutes, and 30 minutes. We described the number and proportion of settings with e-cigarette use observed at any of the three-time points according to country and other contextual variables. Results showed that there were 22 (11.0%) school entrances, eight (4.0%) playgrounds, and 47 (21.3%) outdoor hospitality venues where e-cigarette use was observed at any time point. School entrances and outdoor hospitality venues with observed e-cigarette use were more frequently found in countries with a higher prevalence ($\geq 1.4\%$) of e-cigarette use (school entrances: 18.0% vs. 4.0%; $p=0.002$, outdoor hospitality venues: 26.7% vs. 15.0%, $p=0.036$). In conclusion, the outdoor setting with the highest visibility of e-cigarette use was outdoor areas of hospitality venues. Although still limited, e-cigarettes were also used in outdoor settings frequented by children. Governments should consider measures to restrict e-cigarette use outdoors to protect the health of bystanders, particularly in areas where children may be present.

Keywords: e-cigarette, electronic nicotine delivery systems, passive exposure, outdoor settings

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INTRODUCTION

Electronic cigarettes (e-cigarettes) have become popular in many parts of Europe; their use among adults increased from 12% in 2014 to 15% in 2017¹. However, many toxic substances are present in e-cigarette aerosol², posing potential risks to the health of users³ and non-users passively exposed to its secondhand aerosol (SHA)⁴. Consequently, their use has been regulated in some indoor areas where the use of conventional tobacco products is already forbidden. Despite this, e-cigarette use has been observed in some smoke-free spaces in the United States (US)⁵, even where their use has been explicitly prohibited⁶. In outdoor spaces of dining areas and children's playgrounds in an Australian city, where tobacco smoking was forbidden, e-cigarette use was reported by 36.8% and 8.7% of e-cigarette users, respectively⁷.

As e-cigarette use has been widespread, exposure to SHA among bystanders merits some attention. About 16% of adults in the general population and 37% of adult smokers in Europe reported being exposed to SHA, mostly occurring in indoor areas of bars or restaurants and workplaces or educational venues^{8,9}. In the US, SHA exposure in indoor and outdoor public places among middle and high school students surged, from 25.6% in 2017 to 33.2% in 2018¹⁰. In Europe, younger bystanders and those who live in countries with prevalent e-cigarette use were more likely to be exposed to SHA⁸. Furthermore, seeing e-cigarette use in public places might renormalise smoking among youth¹¹.

Given the increasing prohibitions of tobacco smoking outdoors and the bans on use of e-cigarette indoors, e-cigarette use might be shifted to outdoor venues¹². Furthermore, some of the health issues related to e-cigarette use indoors may also apply to outdoor areas, particularly where people are close together. Thus, an assessment of the extent of e-cigarette use outdoors is warranted; however, the evidence is absent in Europe.

This study aims to describe e-cigarette use in outdoor settings frequented by children or by large numbers of people, namely, school entrances, children's playgrounds, and outdoor hospitality venues in 11 European countries.

MATERIALS AND METHODS

This cross-sectional study, conducted within the framework of the TackSHS Project¹³, aimed to describe e-cigarette use outdoors in primary schools entrances, children's playgrounds, and outdoor hospitality venues, from March 2017 to October 2018, in major cities of 11 European countries: Bulgaria, France, Germany, Greece, Ireland, Italy, Poland, Portugal, Romania,

Spain, and the United Kingdom (UK). The TackSHS project was approved by the Clinical Research Ethics Committee of the Bellvitge University Hospital (PR341/15), and the protocol of this study was approved by all the countries' local Research Ethics Committees.

Detailed methods have been reported elsewhere¹⁴. In brief, we selected densely populated urban areas in Bulgaria (Sofia), France (Paris), Germany (Mannheim, Heidelberg), Greece (Athens), Ireland (Dublin), Italy (Milano, Varese), Poland (Ciechanow, Warsaw), Portugal (Braga), Romania (Bucharest), Spain (Barcelona), and the United Kingdom (Edinburgh) based on opportunistic criteria, considering feasibility. From these cities, we conveniently selected 20 sites for each of the three types of outdoor settings in each country, except for France, where e-cigarette use data was only collected in outdoor hospitality venues. The selection of the sites considered neighbourhoods from different socioeconomic status (SES), which was assessed using local ecological synthetic indexes. When these synthetic indexes were not available, as was the case for Bulgaria, France, Greece, Poland, and Romania, other socioeconomic indicators were used, such as the cost of housing or the rate of poverty, among others. For each setting, half of the observations were made in the lowest SES neighbourhoods (<20th percentile of the SES distribution) and the other half in the highest (>80th percentile of the SES distribution). We visited a total of 200 school entrances, 200 children's playgrounds, and 220 outdoor hospitality venues across all countries.

Observations in school entrances and children's playgrounds were performed before the start or at the end of school hours. In outdoor hospitality venues (i.e., cafeterias, bars, and night pubs), half of the observations were made at any daytime and the other half after dinnertime during the weekdays and weekends. All observations started when at least five people, adults and/or children, were present in each setting.

The use of any type of electronic nicotine/non-nicotine delivery systems that vaporise liquid, hence, not heated tobacco products (e.g., iQOS), was recorded. A trained data collector recorded if e-cigarettes were used in each setting at the beginning (0 minutes), at 15 minutes, and at the end (30 minutes) of the observation period. We determined that an e-cigarette was used if data collectors visually noticed at least one person using e-cigarette at any of the three observation time points.

We reported the overall number and proportion (%) of settings in which e-cigarettes were used, stratified by country, neighbourhood's SES, the country's tobacco control performance according to the Tobacco Control Scale score¹⁵, country's smoking prevalence¹⁶, country's e-

cigarette use prevalence¹³, and existence of national e-cigarette use regulation at the setting (obtained from different sources; see the footnote of Table 1). Chi-squared test was conducted to determine differences in proportions between subgroups at the 0.05 significance level. All analyses were performed with the statistical package Stata 15.

RESULTS

Overall, there were 22 out of 200 (11.0%) school entrances in which e-cigarette use was observed (Table 1). While Greece had the highest proportion (n=8; 40.0%), e-cigarette use was not observed at school entrances in Poland, Portugal, or Spain. School entrances with e-cigarette use were observed four times (18.0% vs. 4.0%; p=0.002) more frequently in countries with higher ($\geq 1.4\%$) national prevalence of e-cigarette use than in countries with lower prevalence.

Table 1 also shows that e-cigarette use was observed in 8 out of 200 (4.0%) children's playgrounds. Most of the venues were found in Ireland (3 playgrounds, 15.0%), while e-cigarette use was not observed in five countries (Bulgaria, Poland, Portugal, Spain, and the UK). No differences were found according to the studied contextual variables.

Finally, e-cigarette use was observed in 47 out of 220 (21.3%) outdoor hospitality venues (Table 1), mainly in Greece and Portugal, in 9 (45.0%) outdoor hospitality venues in each country. In contrast, e-cigarette use was not observed in any of the venues in Spain. Outdoor hospitality venues with e-cigarette use were more frequently observed in countries with a higher national prevalence of e-cigarette use (26.7% vs. 15.0%, p=0.036).

Table 1. Number and proportion* of outdoor settings where electronic cigarette (e-cigarette) use was identified at any observation time¹ according to contextual variables in 11 European countries. TackSHS project, 2017-2018.

	SCHOOL ENTRANCES (N=200)		CHILDREN'S PLAYGROUNDS (N=200)		OUTDOOR HOSPITALITY VENUES (N=220)	
	n (%)	p – value²	n (%)	p – value²	n (%)	p – value²
All	22 (11.0)		8 (4.0)		47 (21.3)	
Country		-		-		-
Bulgaria	1 (5.0)		0 (0.0)		1 (5.0)	
France	-		-		6 (30.0)	
Germany	1 (5.0)		1 (5.0)		1 (5.0)	
Greece	8 (40.0)		1 (5.0)		9 (45.0)	
Italy	3 (15.0)		1 (5.0)		2 (10.0)	
Ireland	4 (20.0)		3 (15.0)		6 (30.0)	
Poland	0 (0.0)		0 (0.0)		3 (15.0)	
Portugal	0 (0.0)		0 (0.0)		9 (45.0)	
Romania	1 (5.0)		2 (10.0)		6 (30.0)	
Spain	0 (0.0)		0 (0.0)		0 (0.0)	
United Kingdom	4 (20.0)		0 (0.0)		4 (20.0)	
Neighbourhood socioeconomic status		0.175		0.141		0.173
High	8 (8.0)		2 (2.0)		27 (25.2)	
Low	14 (14.0)		6 (6.1)		20 (17.7)	
Country's Tobacco Control Scale overall score (2016) ³		0.094		0.753		0.502
<50	10 (16.6)		2 (3.3)		11 (18.3)	
≥50	12 (8.5)		6 (4.3)		36 (22.5)	
Country's tobacco smoking prevalence (%) ⁴		0.651		0.470		0.076
<31.0	12 (12.0)		5 (5.0)		16 (16.0)	
≥31.0	10 (10.0)		3 (3.0)		31 (25.8)	

Country's e-cigarette use prevalence (%) ⁵		0.002		0.149		0.036
<1.4	4 (4.0)		2 (2.0)		215 (15.0)	
≥1.4	18 (18.0)		6 (6.0)		32 (26.7)	
E-cigarette use regulation exists in the setting at the national-level ⁶		0.076		0.059		-
Yes	3 (5.0)		0 (0.0)		-	
No	19 (13.6)		8 (5.7)		47 (21.4)	

*Proportion was reported as a percentage among total observation in the corresponding contextual variable (by row).

¹E-cigarette use data was collected over 30 minutes at three-time points: minute 0', 15', and 30'.

²Chi-squared test.

³Tobacco Control Scale 2016 Ranking: <50 (Bulgaria, Germany, Greece) ≥50 (France, Italy, Ireland, Poland, Portugal, Romania, Spain, UK).

⁴Current tobacco smoking prevalence (2017-2018, TackSHS survey data): <31.0% (Germany, Ireland, Italy, Poland, and the United Kingdom) and ≥31.0% (Bulgaria, France, Greece, Portugal, Romania, and Spain). Cut-off was set at the median of total population current tobacco smoking prevalence across the listed countries (31.0%).

⁵Current e-cigarette use prevalence (2017-2018, TackSHS survey data): <1.4% (Germany, Italy, Poland, Portugal, and Spain) and ≥1.4% (Bulgaria, France, Greece, Ireland, Romania, and the United Kingdom). Cut-off was set at the median of total population e-cigarette use prevalence across the listed countries (1.4%).

⁶Tobaccocontrolaws.org (accessed 20 May 2020), Globaltobaccocontrol.org (accessed 20 May 2020), and countries' national laws. Countries with e-cigarette use regulation in place for (a) School entrances: France, Italy, Poland, and Portugal; (b) Children's playgrounds: Poland, Portugal, and Spain; (c) Outdoor hospitality venues: none.

DISCUSSION

Our findings show that e-cigarette use was observed in the three outdoor settings studied, even those frequented by children, with diversity across European countries. Some contextual factors at the national level can partly contribute to the intercountry differences observed. Country's e-cigarette prevalence, for example, was associated with observed e-cigarette use in school entrances and outdoor hospitality venues. Indeed, Greece, the UK, and Ireland, the countries with the highest proportion of school entrances with observed e-cigarette use, are countries with higher national e-cigarette use prevalence.

Our findings also indicate that e-cigarette use outdoors may happen regardless of the neighbourhood SES and the country's tobacco control performance. Previous studies suggested that e-cigarette use is not associated with individual's place of residence or SES^{17,18}. Socioeconomic factors might play differently in e-cigarette use compared to tobacco smoking depending on attitudes and policies with regard to e-cigarette usage.

Since our study included areas frequented by adults and children, it suggests that the formulation of a comprehensive smoke-free policy should entail consideration of the impact of e-cigarette use on the perception of bystanders, in both population groups. There is evidence that SHA, including visibility of e-cigarette use, among adults may renormalise tobacco smoking, trigger relapse to smoking among quitters, and promote initiation of e-cigarette use and, thus, put current smokers at risk of being dual users as they might start using e-cigarette¹⁹⁻²¹. A previous study has revealed that e-cigarette non-users who were current smokers or former e-cigarette users were more likely to be exposed by SHA⁸. Among youth, seeing e-cigarette use may normalise the use of nicotine-containing products, resulting in an increased risk of starting the use of e-cigarettes and tobacco products in the future^{10,11}. Even among adolescents not susceptible to future cigarette smoking, exposure to the smell from e-cigarette use in indoor or outdoor public places was associated with susceptibility to using e-cigarettes²². As most of the current tobacco control policies tend not to restrict e-cigarette use outdoors, it is advisable that their use is included in outdoor smoking restrictions, especially in areas where children may be present.

The scarcity of e-cigarette use observed in designated areas for children compared to outdoor hospitality venues, as also evident in the outdoor secondhand tobacco smoke exposure in 12 European countries, might be explained by the commonly perceived harms of SHA exposure

for children²³. However, the finding is likely to change over time with the increasing take-up of e-cigarettes, particularly to circumvent smoke-free regulations¹². Having the same e-cigarette use rules as for smoking in outdoor settings might provide simplicity in communication and implementation of the regulations.

The World Health Organization has advised countries to outlaw e-cigarette use in smoke-free places, including smoke-free areas outdoors, to protect non-users from SHA exposure²⁴. Interestingly, we still observed some e-cigarette use activities in three school entrances where e-cigarette use was actually banned. The violation of the law highlights the importance of law enforcement.

Our study was limited by the convenience sampling of the settings selected and, thus, these results are not generalisable. Nevertheless, we monitored the main cities of 11 European countries, representative of different socio-cultural and socioeconomic characteristics. As the e-cigarette users in high SES areas can come from low SES areas, or vice versa, the stratification of settings by neighbourhood SES in this study should not be interpreted as the SES of e-cigarette users. Additionally, the difficult identification of e-cigarette use because of its similarity to other handheld items might influence our estimates. However, our data collectors were moving around the areas to maximise the observations. Given the limited duration of observation, our results might underestimate the real e-cigarette use in these settings; a longer observation period in future studies is warranted. Notwithstanding the limitations, this is the first multi-country study describing e-cigarette use in outdoor settings that considered different contextual determinants using a standardised protocol.

CONCLUSIONS

Our results show that e-cigarette use was observed in outdoor settings, including those frequented by children, across 11 European countries. Governments should consider strengthening their tobacco control policy by extending the smoke-free laws to cover e-cigarette use in outdoor places, especially those where children are present and people are close together, as well as effectively enforcing the laws.

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