European Journal of Public Health, Vol. 30, No. Supplement 3, iii55–iii61

doi:10.1093/eurpub/ckaa055

Impact of the Tobacco Products Directive on self-reported exposure to e-cigarette advertising, promotion and sponsorship in smokers—findings from the EUREST-PLUS ITC Europe Surveys

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Background: Advertising, promotion and sponsorship of electronic cigarettes (ECAPS) have increased in recent years. Since May 2016, the Tobacco Products Directive 2014/40/EU (TPD2) prohibits ECAPS in various advertising channels, including media that have cross-border effects. The objective of this study was to investigate changes in exposure to ECAPS in a cohort of smokers from six European Union member states after implementation of TPD2. **Methods:** Self-reported exposure to ECAPS overall and in various media and localities was examined over two International Tobacco Control Policy Evaluation survey waves (2016 and 2018) in a cohort of 6011 adult smokers from Germany, Greece, Hungary, Poland, Romania and Spain (EUREST-PLUS Project) using longitudinal generalized estimating equations models. **Results:** Self-reported ECAPS exposure at both timepoints varied between countries and across examined advertising channels. Overall, there was a significant increase in ECAPS exposure [adjusted odds ratio (aOR): 1.25, 95% CI: 1.09–1.44]. Between waves, no consistent patterns of change in ECAPS exposure across countries and different media were observed. Generally, ECAPS exposure tended to decline in some channels regulated by TPD2, particularly on television and radio, while exposure tended to increase in some unregulated channels, such as at points of sale. **Conclusions:** The findings suggest that the TPD2 was generally effective in reducing ECAPS in regulated channels. Nonetheless, further research is warranted to evaluate its role in reducing ECAPS exposure, possibly by triangulation with additional sources of data.

Introduction

Comprehensive bans on tobacco advertising, promotion and sponsorship (TAPS) are known to be effective measures to reduce smoking prevalence.[1] Despite this, TAPS regulation worldwide, including in Europe, remains heterogenous.[2–4]

Less is known about the impact of advertising, promotion and sponsorship of electronic cigarettes (e-cigarettes) (ECAPS). Studies suggest an association between exposure to e-cigarette marketing and intention to use, trial and use of e-cigarettes, as well as lower harm perceptions of e-cigarettes, in both adults and adolescents.[5–11] It has also been shown that many of the marketing strategies used by e-cigarette companies are similar to those employed by the tobacco industry for cigarettes.[12] Moreover, promotional expenditures for e-cigarettes have increased rapidly in recent years.[13]

There are now 68 countries worldwide that prohibit or regulate e-cigarette marketing, with eight of these countries only regulating nicotine-containing e-cigarettes.[14] In the European Union (EU), regulation of e-cigarette marketing was first imposed by the Tobacco Products Directive 2014/40/EU (TPD2), which was transposed into national law by member states (MS) by 20 May 2016. In addition to other regulations concerning product characteristics and requirements for health warnings (Article 20), the TPD2 prohibits advertising and promotion of e-cigarettes in media that have cross-border effects, i.e. television (TV), radio, the press and other printed publications, the internet and events involving or taking place in several MS or otherwise having cross-border effects.[15] As the TPD2 recommended 'a restrictive approach to advertising electronic cigarettes and refill containers', some countries imposed additional national advertising restrictions beyond those required by the TPD2 (table 1).

The objective of this study was to examine changes in self-reported exposure to ECAPS before and after implementation of the TPD2 in a longitudinal sample of smokers from six EU MS (Germany, Greece, Hungary, Poland, Romania and Spain). As advertising bans in single channels can lead to a displacement of advertising to other channels,[16] we investigated exposure to various media platforms (TV, radio, billboards, print, online and mail) and localities (points of sale, events and bars/pubs), some that go beyond TPD2 regulations. Secondary objectives were to explore determinants of ECAPS exposure, and to examine country differences.

Methods

Study design

This study was conducted within the context of the European Commission Horizon-2020 funded project entitled European Regulatory Science on Tobacco: Policy Implementation to Reduce Lung Diseases (EUREST-PLUS).[17] EUREST-PLUS involved the creation of an International Tobacco Control (ITC) Policy Evaluation Project cohort of adult smokers in six EU MS (Germany, Greece, Hungary, Poland, Romania and Spain), which was designed to assess the implementation of the TPD2 and the World Health Organization Framework Convention on Tobacco Control at the European level. The conceptual model of the ITC Project is based on a theory-driven framework which hypothesizes the mediational pathways of tobacco control policies on tobacco use behaviours.[18] Data from Waves 1 and 2 of the ITC 6 European Country (ITC 6E) survey were used for this study.

Data collection

The ITC 6E Wave 1 (W1) sample, collected between 16 June 2016 and 12 September 2016, comprised of 6011 nationally representative cigarette smokers aged 18 or older (about 1000 in each of the six countries). Wave 2 (W2) was conducted after the TPD2 implementation from 12 February 2018 to 6 May 2018. The W2 sample was comprised of 6027 smokers and recent quitters (those who had quit since W1), including both W1 survey respondents who were successfully re-contacted ($n = 3195$) and newly recruited adult smokers ($n = 2832$) to replenish those who were not successfully re-contacted. The W2 retention rates were 71% in Germany, 41% in Greece, 36% in Hungary, 48% in Poland, 54% in Romania and 70% in Spain, with an overall retention rate of 53%.

Participants were sampled from geographic strata according to the Classification of Territorial Units for Statistics (NUTS) crossed with degree of urbanization (urban, intermediate and rural). Approximately 100 area clusters were sampled in each country, which were allocated to strata proportionally to the adult population size. Within each cluster, household addresses were sampled using a random walk design. Where possible, one randomly selected male smoker and one randomly selected female smoker were chosen for an interview from each sampled household. Screening of households continued until the required number of smokers from the cluster had been interviewed. All interviews were conducted face-to-face using tablets (computer-assisted personal interview). Further details can be found elsewhere.[18–21]

Study ethics procedures

The study was approved by the Research Ethics Board of the University of Waterloo, Ontario, Canada and by local ethics boards within study countries. Participation in the study was contingent on provision of individual informed consent, which was obtained either in written or verbal form according to local ethical requirements.

Measures

The questionnaires included relevant socio-demographic measures, such as sex, age, marital status, education and degree of urbanization. We categorized age into four groups (18–24, 25–39, 40–54 and 55 years and older). Marital status was classified into two groups (not married, widowed, divorced or separated vs. not married but living together, married or registered partners). In each country, education was reclassified to match International Standard Classification of Education coding, which was, in turn, categorized into low (pre-primary, primary and lower secondary), moderate (upper secondary, post-secondary non-tertiary and short-cycle tertiary) and high (bachelor or equivalent, master or equivalent and doctoral or equivalent).

Smoking status was categorized into 'daily', 'less than daily' (either 'Weekly', 'Monthly' or 'Less than monthly'), and, for W2 only, 'quit recently' (either 'Quit in last month', 'Quit in last 1–6 months' or 'Quit more than 6 months ago'). Current e-cigarette use was determined by asking 'On average, how often do you currently use e-cigarettes or vaping devices?' Responses were dichotomized into 'current e-cigarette use' ('Daily', 'Weekly', 'Monthly', 'Less than monthly') and 'no current e-cigarette use'.

To assess self-reported exposure to ECAPS, respondents who confirmed they had heard of e-cigarettes were asked whether they had noticed e-cigarettes or vaping devices being advertised in the following media and localities in the last 6 months: (i) on TV, (ii) on radio, (iii) on posters or billboards, (iv) in newspapers or magazines, (v) outside shops or stores that sell tobacco; this includes signs in windows, visible from the outside, (vi) inside shops or stores that sell tobacco, (vii) on social media sites, like Facebook, Twitter, YouTube, Instagram, or Snapchat, (viii) on the internet, (ix) at festivals, (x) at sporting events, (xi) in regular postal mail they received, (xii) in e-mail or text message(s) they have received and (xiii) in bars or pubs. Response options for each were 'Yes', 'No', 'Don't use/Don't encounter' and 'Don't know'. For analysis, questions (vii) and (viii) were combined into one variable 'social media or internet', questions (ix) and (x) into 'festivals or sporting events' and (xi) and (xii) into 'postal mail, e-mail, or text messages'. Respondents who stated they neither use nor encounter a certain medium or locality were excluded from the exposure prevalence calculation for this medium/locality. To measure overall awareness of e-cigarette advertising, all individual questions on media and localities were combined to form a single variable 'Noticed e-cigarette advertising in any medium or locality in the last 6 months' with the two categories 'Yes' or 'No/Don't know'.

Statistical analysis

Cross-sectional prevalence at each wave of having noticed e-cigarette advertising in the last 6 months overall and separately by medium or locality was reported for each country. Generalized estimating equations (GEE) models, allowing the analysis of data from individuals across multiple waves, were computed to examine changes in self-reported exposure to ECAPS over time as well as associations with socio-demographic variables, smoking behaviour and e-cigarette

Table 1 Bans (■) on e-cigarette advertising in various media and localities prescribed by TPD2 and in the six examined EU countries

	TPD2	Germany	Greece	Hungary	Poland	Romania	Spain
Since	20/05/2016	20/05/2016	20/09/2016	20/05/2016	08/09/2016	10/12/2016	18/11/2017
TV	■	■	■	■	■	■	■
Radio	■	■	■	■	■	■	■
Billboards	○	○	○	■	■	■	○
Print[a]	■	■	■	■	■	■	■
Points of sale	○	○	○	■	■	○	○
Internet	■	■	■	■	■	■	■
National events	○	○	○	■	■	■	○
International events[b]	■	■	■	■	■	■	■
Mail	○	○	○	■	■	○	○
Bars/pubs	○	○	○	■	■	○	○

a: Excludes the print media intended exclusively for professionals in the trade of e-cigarettes or refill containers and of the print media printed and circulating in third countries, where the print media in question are not intended primarily for the market of the Union.
b: Events involving or taking place in several MS or otherwise having cross-border effects.
■, ban existent; ○, no ban.

use. Separate GEE models were fitted for overall awareness of e-cigarette advertising and for each medium/locality. These included 'country X wave' interaction terms, allowing a detailed examination of country differences in change in noticing ECAPS in each medium/locality. Finally, a single GEE model examined predictors of overall change in noticing any form of e-cigarette advertising. The models were fitted using the following specifications: binomial distribution, logit link and exchangeable correlation structure. All GEE models included time-invariant measures assessed at each respondent's first interview (sex, age group, education, marital status, degree of urbanization and country) as well as the time-varying variables wave, smoking status and current e-cigarette use assessed at each wave. All statistical tests were two-sided, with an alpha level of 0.05. SAS v9.4 was used for descriptive analyses, and SAS-callable SUDAAN (Version 11.0.3) for GEE models to account for the complex sampling design, longitudinal sampling weights and repeated measures.[20,21]

Results

Across the six EU MS, the majority of participants were male, middle aged, of low or moderate educational level, living with a partner and living in a non-rural area. In all countries, the vast majority of smokers were daily smokers. At the time of W2, between 4.3% (Poland) and 10.3% (Spain) of the respondents had quit smoking. E-cigarette use was around 5% or lower in all countries at W1, but had increased slightly in Germany, Greece, Hungary and Spain by W2, with the greatest increase in Spain (from 1.1% in W1 to 4.8% in W2). A detailed overview of the distribution of socio-demographic and smoking-related characteristics of the cross-sectional and longitudinal samples can be found in Supplementary table S1.

In figure 1, the proportions of those who reported having noticed any e-cigarette advertising in the last 6 months are presented by survey wave and country. The percentage of respondents who reported having been exposed to ECAPS increased in four of the six countries from W1 to W2, while a decrease was seen in Poland and Romania. The percentage who reported having noticed any e-cigarette advertising was highest in Germany (W1: 57.1%, W2: 62.4%) and lowest in Hungary (W1: 25.2%, W2: 29.1%) and Spain (W1: 19.4%, W2: 30.8%).

Table 2 shows the percentages of self-reported exposure to ECAPS for the various media and localities by country and wave. While large variation by country was observed, a consistent finding was that ECAPS tended to be most commonly noticed at point of sale; particularly inside shops that sell tobacco, but also outside of them. The highest rates of reported exposure at point of sale were found in Germany at both survey waves (outside: W1: 31.6%, W2: 41.8%; inside: W1: 41.0%, W2: 47.8%) and in Greece at W2 (outside: 34.6%, inside: 39.5%). Billboard/poster advertising was most frequently noticed in Germany (W1: 21.6%, W2: 26.9%), while exposure on social media or the internet was also generally high, particularly in Romania (W1: 30.8%, W2: 25.1%). In all countries, e-cigarette advertising was rarely noticed on the radio, at festivals or sport events, in regular postal mail, e-mails or text messages and in bars or pubs. Reported exposure to ECAPS on the TV was also relatively low in each country especially at W2, with the exception of Romania (20.8% in W1 and 24.2% in W2).

Table 3 presents the results of adjusted GEE models estimating the change from W1 to W2 in having noticed e-cigarette advertising by country, both overall and separately for each medium or locality. Overall awareness of e-cigarette advertising increased significantly in Spain [adjusted odds ratio (aOR): 1.98, 95% CI: 1.37–2.85] and Greece (aOR: 1.73, 95% CI: 1.27–2.37), and declined significantly in Poland (aOR: 0.68, 95% CI: 0.48–0.95).

In Poland, exposure to ECAPS declined in all examined media and localities over time, with the decline being statistically significant for TV, newspapers/magazines, outside shops that sell tobacco and the internet. On the other hand, Spain showed increases in exposure to ECAPS for all media and localities except radio, with the increase being significant for newspapers/magazines, insides and outsides of shops that sell tobacco, social media/internet and festivals/sports events.

No significant changes between waves were seen in Romania. In Hungary, only poster/billboard advertising increased significantly. A mixed picture was seen in Germany and Greece, with ECAPS exposure significantly increasing in some media/localities (Germany: outside shops that sell tobacco and mail, e-mails and text messages; Greece: inside and outside shops that sell tobacco) and significantly decreasing in others (Germany: TV and radio; Greece: radio, newspapers/magazines and bars/pubs).

In the pooled sample, overall exposure to ECAPS in any medium or locality was significantly higher at W2 than at W1 (aOR = 1.25, 95% CI: 1.09–1.44) (Supplementary table S2). Factors independently associated with higher self-reported ECAPS exposure were male gender, living in an urban area, smoking less than daily and being a current e-cigarette user. Moreover, a clear and significant age gradient was observed, with younger respondents being more likely to notice ECAPS. Finally, lower educated respondents tended to notice ECAPS less than higher educated respondents, though this association was not statistically significant. Clear country differences were also observed, with respondents in Germany, Greece, Romania and Poland being more likely to notice ECAPS than respondents in Spain.

Discussion

This study examined changes in self-reported exposure to ECAPS in a cohort of smokers from six EU MS after implementation of the

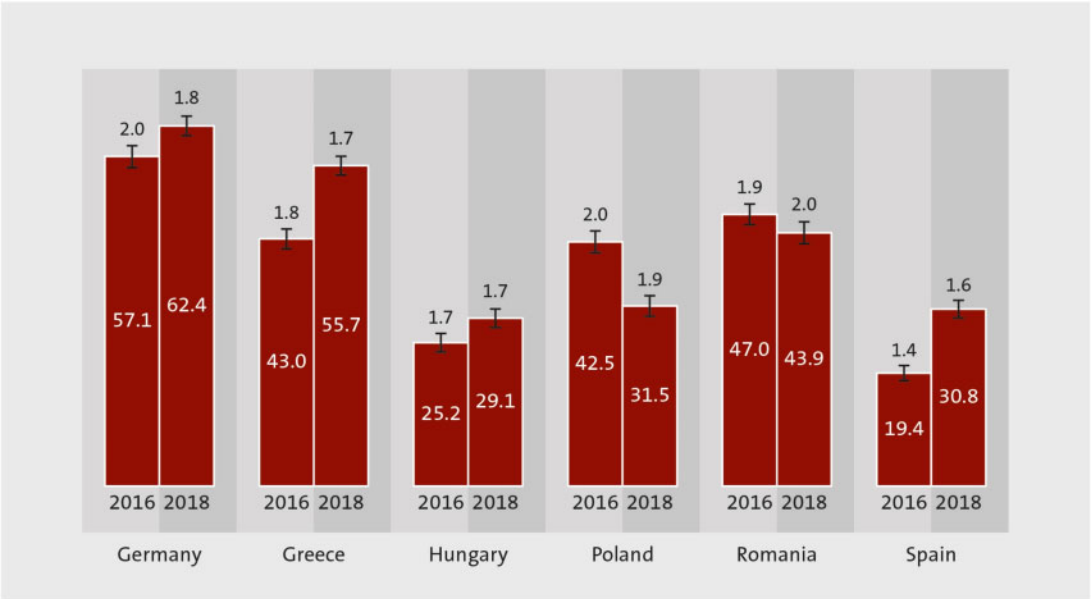

Figure 1 Awareness of e-cigarette advertising in any medium or locality in the last 6 months by survey wave and country; percentages and standard errors are reported.

Table 2 Awareness of e-cigarette advertising in various media and localities by country among those who ever heard of e-cigarettes and used or encountered the medium or locality

	Germany		Greece		Hungary		Poland		Romania		Spain	
	2016 *N*=624	2018 *N*=727	2016 *N*=771	2018 *N*=805	2016 *N*=692	2018 *N*=714	2016 *N*=688	2018 *N*=571	2016 *N*=720	2018 *N*=635	2016 *N*=836	2018 *N*=894
TV (*n*)	(615)	(722)	(760)	(803)	(645)	(672)	(614)	(541)	(701)	(621)	(812)	(867)
Thereof % noticed ECAPS	19.2	6.7	5.0	3.5	6.5	4.4	11.3	4.7	20.8	24.2	4.6	5.3
Radio (*n*)	(617)	(716)	(759)	(803)	(641)	(666)	(609)	(538)	(695)	(617)	(812)	(867)
Thereof % noticed ECAPS	2.7	0.3	6.8	1.4	1.6	2.9	4.2	2.4	5.1	5.6	1.2	0.5
Posters or billboards (*n*)	(615)	(722)	(756)	(799)	(639)	(669)	(608)	(543)	(694)	(612)	(811)	(868)
Thereof % noticed ECAPS	21.6	26.9	14.6	16.2	2.2	5.9	10.4	6.0	13.1	15.0	2.6	7.3
Newspapers or magazines (*n*)	(616)	(709)	(751)	(785)	(628)	(667)	(610)	(538)	(689)	(615)	(811)	(863)
Thereof % noticed ECAPS	19.7	20.0	14.5	8.2	2.7	3.9	11.1	4.8	13.6	10.2	2.6	8.2
Outside tobacco-selling shops (*n*)	(619)	(719)	(759)	(803)	(643)	(673)	(606)	(529)	(692)	(617)	(808)	(866)
Thereof % noticed ECAPS	31.6	41.8	16.9	34.6	7.0	8.8	16.7	8.9	16.1	16.7	4.6	9.8
Inside tobacco-selling shops (*n*)	(618)	(714)	(759)	(798)	(642)	(678)	(610)	(524)	(690)	(619)	(809)	(865)
Thereof % noticed ECAPS	41.0	47.8	14.4	39.5	14.4	20.0	26.0	21.0	18.0	21.5	11.9	19.0
Social media or internet (*n*)	(594)	(699)	(733)	(747)	(621)	(646)	(594)	(517)	(685)	(608)	(804)	(854)
Thereof % noticed ECAPS	16.9	19.0	21.5	22.6	7.1	10.0	18.3	11.3	30.8	25.1	5.5	12.2
Festivals or sport events (*n*)	(576)	(670)	(715)	(723)	(597)	(617)	(569)	(505)	(683)	(607)	(804)	(844)
Thereof % noticed ECAPS	6.2	7.5	1.6	0.9	2.7	2.6	4.1	2.1	7.2	8.0	0.5	2.2
Postal mail, e-mails, or text messages (*n*)	(601)	(706)	(725)	(770)	(619)	(656)	(595)	(540)	(681)	(614)	(805)	(858)
Thereof % noticed ECAPS	2.7	5.5	1.4	1.8	1.2	1.3	3.9	2.1	9.6	7.6	0.6	1.5
Bars or pubs (*n*)	(600)	(698)	(745)	(776)	(614)	(642)	(594)	(525)	(692)	(614)	(808)	(863)
Thereof % noticed ECAPS	6.8	5.9	2.2	1.0	0.8	1.7	4.4	3.2	8.8	12.7	2.0	2.7

N, number of respondents who had ever heard of e-cigarettes; *n*, number of respondents who had used or encountered the medium or locality.

TPD2. All MS had introduced bans on ECAPS on TV, radio, in print media, the internet and at international events in accordance with the TPD2 at the time of W2 (table 1). At W1, no e-cigarette advertising bans were implemented in these countries or had just been newly introduced (Germany, Greece and Hungary). Since the study questions measuring awareness of e-cigarette advertising relate to the 6-month period before the survey, the W1 survey measure reflects the pre-TPD2 situation in all countries (exact survey periods can be found elsewhere).[20,21]

Some countries went beyond TPD2 in their regulation of ECAPS. Hungary, Poland and Romania also prohibited outdoor e-cigarette advertising, such as on billboards. Hungary and Poland introduced the most extensive advertising bans of the six countries since e-cigarette advertising is additionally banned at point of sale, at national events and in bars/pubs.

Generally, reported noticing of ECAPS was most prevalent in Germany, and least in Spain and Hungary. Our analyses showed a small, but statistically significant increase in the awareness of e-cigarette advertising in the pooled sample, mainly attributable to more moderate increases in Greece and Spain, while a significant decrease was observed in Poland. Overall, self-reported exposure to ECAPS via channels regulated under the TPD2 tended to decrease, such as TV and radio, while exposure to ECAPS from less regulated channels, particularly at the point of sale and on posters/billboards, tended to increase. Exposure via other less regulated direct marketing channels, such as direct messages or in bars and pubs, mostly remained at low levels.

No consistent patterns of change were seen for ECAPS in social media and on the internet despite advertising bans in media with cross-border effects. Exposure significantly decreased in Poland and significantly increased in Spain; however, levels at W2 were similar

Table 3 Results of GEE models estimating the change between survey waves in having noticed e-cigarette advertising overall, as well as in various media and localities in the last 6 months; longitudinal data; aOR are presented

	Germany		Greece		Hungary		Poland		Romania		Spain	
	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)
Overall	Number of observations used: 8328/number of individuals included: 6543/events: 3328											
(W2 vs. W1)	1.24	(0.90–1.72)	1.73	(1.27–2.37)	1.20	(0.84–1.72)	0.68	(0.48–0.95)	0.96	(0.71–1.30)	1.98	(1.37–2.85)
TV	Number of observations used: 8243/number of individuals included: 6475/events: 756											
(W2 vs. W1)	0.31	(0.18–0.54)	0.74	(0.33–1.67)	0.65	(0.32–1.30)	0.34	(0.19–0.60)	1.26	(0.85–1.86)	1.59	(0.67–3.77)
Radio	Number of observations used: 8210/number of individuals included: 6457/events: 218											
(W2 vs. W1)	0.09	(0.02–0.36)	0.19	(0.08–0.48)	2.01	(0.81–4.97)	0.59	(0.24–1.46)	1.22	(0.60–2.48)	0.47	(0.14–1.59)
Posters/billboards	Number of observations used: 8205/number of individuals included: 6452/events: 944											
(W2 vs. W1)	1.44	(0.95–2.19)	1.14	(0.76–1.72)	2.82	(1.30–6.12)	0.51	(0.25–1.06)	1.30	(0.76–2.23)	1.94	(0.76–4.98)
Newspapers/magazines	Number of observations used: 8156/number of individuals included: 6416/events: 795											
(W2 vs. W1)	1.02	(0.72–1.45)	0.49	(0.31–0.80)	1.44	(0.73–2.86)	0.40	(0.20–0.81)	0.76	(0.46–1.25)	2.93	(1.39–6.18)
Outside tobacco-selling shops	Number of observations used: 8200/number of individuals included: 6449/events: 1471											
(W2 vs. W1)	1.65	(1.15–2.37)	2.65	(1.79–3.92)	1.25	(0.67–2.32)	0.53	(0.33–0.88)	1.14	(0.77–1.70)	2.27	(1.44–3.58)
Inside tobacco-selling shops	Number of observations used: 8186/number of individuals included: 6449/events: 1987											
(W2 vs. W1)	1.35	(0.95–1.94)	4.03	(2.59–6.28)	1.46	(0.95–2.23)	0.80	(0.55–1.17)	1.34	(0.94–1.91)	2.09	(1.41–3.11)
Social media/internet	Number of observations used: 7952/number of individuals included: 6290/events: 1236											
(W2 vs. W1)	1.08	(0.71–1.63)	1.06	(0.71–1.58)	1.46	(0.77–2.78)	0.59	(0.38–0.92)	0.80	(0.55–1.15)	2.06	(1.25–3.39)
Festivals/sport events	Number of observations used: 7753/number of individuals included: 6173/events: 265											
(W2 vs. W1)	1.26	(0.74–2.13)	0.50	(0.18–1.41)	0.96	(0.37–2.53)	0.61	(0.24–1.53)	1.18	(0.66–2.10)	3.90	(1.39–10.95)
Mail/e-mails/text messages	Number of observations used: 7982/number of individuals included: 6294/events: 221											
(W2 vs. W1)	2.23	(1.10–4.52)	1.28	(0.55–3.01)	1.28	(0.32–5.08)	0.61	(0.28–1.34)	0.88	(0.44–1.76)	1.67	(0.63–4.44)
Bars/pubs	Number of observations used: 8027/number of individuals included: 6352/events: 290											
(W2 vs. W1)	0.82	(0.46–1.47)	0.34	(0.13–0.88)	2.14	(0.59–7.72)	0.84	(0.41–1.69)	1.73	(0.93–3.21)	1.28	(0.52–3.18)

Note: Odds ratios adjusted for gender, age group, education, marital status, degree of urbanization, smoking status and e-cigarette use. W1, Wave 1; W2, Wave 2.

in both countries at around 10%. In Germany, Greece and Romania, social media and the internet are among the more prevalent sources of ECAPS exposure (around 20–25% at W2) with no significant changes between survey waves. This comparably high exposure is in line with other studies demonstrating the strong presence of e-cigarettes on social media platforms.[22,23] It is difficult to assess whether this actually points to a lack of compliance among e-cigarette companies with advertising restrictions on the internet and social media platforms, as it might be difficult for users to distinguish between real commercial ads and other unpaid content shared by users that could be perceived as promotional.[24] Regulating such non-commercial user-created promotional content is challenging, as is regulating access to paid promotional content originating from outside the EU.

Our finding that ECAPS has increased over time is generally in line with other studies, some of which have used more objective data sources, such as advertising spending, particularly at the point of sale.[5,25,26] This finding is of high public health importance, as studies have suggested that recall of ECAPS, particularly at the point of sale and on the internet, is associated with e-cigarette use among adolescents.[27–30] On the other hand, exposure of smokers to ECAPS—who were the subjects of this study—might increase quit intentions and promote the use of e-cigarettes in quit attempts. Further research is however needed to determine whether commercial messages in ECAPS actually aid or undermine smoking cessation[31,32]; it is possible that this depends on the content of these messages.

A significant strength of this study is that the surveys were based on large national probability samples of smokers from six EU MS, using standardized survey questions that ensure good comparability across countries. Nonetheless, a few limitations need to be considered when interpreting the results. First, this study is based on self-reported recall of exposure to ECAPS. This means that our measurements are subject to recall bias and might strongly depend on the awareness of e-cigarettes and ECAPS. While we explicitly asked about exposure to advertising, it is nevertheless possible that exposure to other types of a favourable depiction of e-cigarettes, such as through social media posts or movies, might be misreported as ECAPS exposure. Also, some respondents may have reported advertising exposure that occurred prior to 6 months ago. Thus, some overreporting especially after implementation of the TPD2 (i.e. at W2) cannot be ruled out. However, despite its potential flaws, self-reported exposure is widely used as a standard method in surveys on advertising exposure and considered a good marker of real-life effectiveness of advertising bans. Second, the exposure variables used in this study were binary measures and do not capture the frequency of exposure. This is important to consider when interpreting differences between countries, as self-reported exposure to ECAPS in a country with stronger regulations might reflect less frequent actual exposure than self-reported exposure in a country with weaker regulations. Therefore, country differences in terms of actual exposure to ECAPS might, therefore, be even larger than our data suggests. Finally, while the longitudinal design of our study can provide some indication of the timing of exposure in relation to the introduction of TPD2, the observational nature of the study does not allow for any causal conclusions.

Conclusions

Our study found cross-country variation in exposure to ECAPS at both survey waves, i.e. before and after the implementation of ECAPS bans as required by the TPD2. Our findings indicate that ECAPS exposure declined in some channels regulated by TPD2, particularly on TV and radio, while exposure increased in some unregulated channels, such as at the point of sale. While this suggests that the TPD2 might have been effective in reducing ECAPS to some extent, further research is warranted to evaluate the role of the TPD2 in reducing ECAPS exposure, possibly by triangulating self-reported data with other more objective sources of data (e.g. advertising expenditure). The fact that higher ECAPS exposure was found in places where also non-smokers and adolescents could be potentially exposed—such as billboards, stores that sell tobacco, social media and internet—warrants more comprehensive regulation and

effective enforcement in order to prevent initiation of e-cigarette use among these groups.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

E.F. thanks CERCA Programme/Generalitat de Catalunya for institutional support.
*EUREST-PLUS consortium members: European Network on Smoking and Tobacco Prevention (ENSP), Belgium: Constantine I. Vardavas, Andrea Glahn, Christina N. Kyriakos, Dominick Nguyen, Katerina Nikitara, Cornel Radu-Loghin, Polina Starchenko. University of Crete (UOC), Greece: Aristidis Tsatsakis, Charis Girvalaki, Chryssi Igoumenaki, Sophia Papadakis, Aikaterini Papathanasaki, Manolis Tzatzarakis, Alexander I. Vardavas. Kantar Public, Belgium: Nicolas Bécuwe, Lavinia Deaconu, Sophie Goudet, Christopher Hanley, Oscar Rivière. Smoking or Health Hungarian Foundation (SHHF), Hungary: Tibor Demjén, Judit Kiss, Anna Piroska Kovacs. Catalan Institute of Oncology (ICO) and Bellvitge Biomedical Research Institute (IDIBELL), Spain: Esteve Fernández, Yolanda Castellano, Marcela Fu, Sarah O. Nogueira, Olena Tigova. Kings College London (KCL), UK: Ann McNeill, Katherine East, Sara C. Hitchman. German Cancer Research Center (DKFZ), Germany: Ute Mons, Sarah Kahnert. National and Kapodistrian University of Athens (UoA), Greece: Yannis Tountas, Panagiotis Behrakis, Filippos T. Filippidis, Christina Gratziou, Paraskevi Katsaounou, Theodosia Peleki, Ioanna Petroulia, Chara Tzavara. Aer Pur Romania, Romania: Antigona C. Trofor, Marius Eremia, Lucia Lotrean, Florin Mihaltan. European Respiratory Society (ERS), Switzerland: Gernot Rohde, Tamaki Asano, Claudia Cichon, Amy Far, Céline Genton, Melanie Jessner, Linnea Hedman, Christer Janson, Ann Lindberg, Beth Maguire, Sofia Ravara, Valérie Vaccaro, Brian Ward. Maastricht University, the Netherlands: Marc Willemsen, Hein de Vries, Karin Hummel, Gera E. Nagelhout. Health Promotion Foundation (HPF), Poland: Witold A. Zatoński, Aleksandra Herbeć, Kinga Janik-Koncewicz, Krzysztof Przewoźniak, Mateusz Zatoński. University of Waterloo (UW), Canada: Geoffrey T. Fong, Thomas K. Agar, Pete Driezen, Shannon Gravely, Anne C.K. Quah, Mary E. Thompson.

Funding

The EUREST-PLUS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 681109 (C.I.V.) and the University of Waterloo (G.T.F.). Additional support was provided to the University of Waterloo by the Canadian Institutes of Health Research (FDN-148477). S.K. is supported by the German Federal Ministry of Health. G.T.F. was supported by a Senior Investigator Grant from the Ontario Institute for Cancer Research. E.F. was partly supported by Ministry of Universities and Research, Government of Catalonia (2017SGR319) and by the Instituto Carlos III and co-funded by the European Regional Development Fund, FEDER (INT16/00211 and INT17/00103), Government of Spain.

Conflicts of interest: The authors declare that they have no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript or in thedecision to publish the results. G.T.F. has served as an expert witness on behalf of governments in litigation involving the tobacco industry. K.P. reports grants and personal fees from the Polish League Against Cancer, outside the submitted work.

Key points

- The Tobacco Products Directive 2014/40/EU (TPD2) prohibits advertising and promotion of e-cigarettes in media that have cross-border effects, i.e. television (TV), radio, the press and other printed publications, the internet and international events.
- This study aimed to examine changes in exposure to e-cigarette advertising, promotion and sponsorship (ECAPS) after implementation of the TPD2 among smokers from six European Union member states.
- We found wide variation in exposure to ECAPS between countries and across different advertising channels, some of which are regulated through TPD2 or national legislation.
- While no consistent patterns of change in overall ECAPS exposure were observed, our findings indicate that TPD2 was generally effective in reducing ECAPS exposure in channels regulated by TPD2, particularly on TV and radio.

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