

# Awareness and correlates of noticing changes to cigarette packaging design after implementation of the European Tobacco Products Directive

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# Awareness and correlates of noticing changes to cigarette packaging design after implementation of the European Tobacco Products Directive: findings from the EUREST-PLUS ITC Europe Surveys

Christina N. Kyriakos<sup>1,2</sup>, Pete Driezen<sup>3,4</sup>, Charis Girvalaki<sup>1,2</sup>, Sara C. Hitchman<sup>5</sup>, Filippos T. Filippidis<sup>6,7</sup>, Shannon Gravely<sup>3</sup>, James Balmford<sup>8</sup>, Katerina Nikitara<sup>2</sup>, Ute Mons<sup>9</sup>, Esteve Fernández<sup>10,11,12,13</sup>, Krzysztof Przewoźniak<sup>14,15,16</sup>, Antígona C. Trofor<sup>17,18</sup>, Tibor Demjén<sup>19</sup>, Witold Zatoński<sup>14,20</sup>, Yannis Tountas<sup>7</sup>, Geoffrey T. Fong<sup>1,3,21</sup>, Constantine I. Vardavas<sup>1,2</sup>, on behalf of the EUREST-PLUS Consortium\*

1 Laboratory of Toxicology, School of Medicine, University of Crete, Heraklion, Greece

2 European Network for Smoking and Tobacco Prevention, Brussels, Belgium

3 Department of Psychology, University of Waterloo, Waterloo, Canada

4 School of Public Health and Health Systems, University of Waterloo, Waterloo, Canada

5 Addictions Department, King's College London, London, UK

6 Department of Primary Care and Public Health, Imperial College London, London, UK

7 Center for Health Services Research, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece

8 Institute of Medical Biometry and Statistics, Faculty of Medicine and Medical Center, University of Freiburg, Freiburg im Breisgau, Germany

9 Cancer Prevention Unit and WHO Collaborating Centre for Tobacco Control, German Cancer Research Center (DKFZ), Heidelberg, Germany

10 Tobacco Control Unit, Catalan Institute of Oncology (ICO), L'Hospitalet de Llobregat (Barcelona), Catalonia, Spain

11 Tobacco Control Research Group, Bellvitge Biomedical Research Institute (IDIBELL), L'Hospitalet de Llobregat, Catalonia, Spain

12 School of Medicine and Health Sciences, Bellvitge Campus, Universitat de Barcelona, L'Hospitalet de Llobregat, Catalonia, Spain

13 Consortium for Biomedical Research in Respiratory Diseases (CIBER of Respiratory Diseases, CIBERES), Madrid, Spain

14 Health Promotion Foundation, Warsaw, Poland

15 Maria Skłodowska-Curie National Research Institute of Oncology, Warsaw, Poland

16 Collegium Civitas, Warsaw, Poland

17 University of Medicine and Pharmacy 'Grigore T. Popa' Iasi, Iasi, Romania

18 Aer Pur Romania, Bucharest, Romania

19 Smoking or Health Hungarian Foundation, Budapest, Hungary

20 European Observatory of Health Inequalities, President Stanislaw, Wojciechowski State University of Applied Sciences, Kalisz, Poland

21 Ontario Institute for Cancer Research, Toronto, ON, Canada

**Correspondence:** Constantine I. Vardavas, Laboratory of Toxicology, Faculty of Medicine, University of Crete, University Campus, Voutes, Heraklion 71003, Greece, Tel/Fax: +30 28 105 42098, e-mail: vardavas@tobcontrol.eu

\*The members of the EUREST-PLUS Consortium are listed in in the Acknowledgements.

**Background:** The European Tobacco Products Directive (TPD), which went into effect in May 2016, regulates packaging design and labelling of cigarettes and roll-your-own (RYO) tobacco. The aim of the current study was to examine whether smokers and recent quitters in six European Union (EU) countries (Germany, Greece, Hungary, Poland, Romania and Spain) reported noticing TPD-related changes to packaging, and correlates of noticing these changes. **Methods:** Cross-sectional data from the Wave 2 of the ITC 6 European Country Survey in 2018 after implementation of the TPD. Bivariate analyses included adult smokers ( $n = 5597$ ) and recent quitters ( $n = 412$ ). Adjusted logistic regression analyses were restricted to the subset of current smokers ( $n = 5597$ ) and conducted using SAS-callable SUDAAN. **Results:** Over half of smokers (58.2%) and 30% of quitters noticed at least one of five types of TPD-related pack changes. Over one-quarter of all respondents noticed changes to health warnings (30.0%), standardized openings (27.7%), minimum pack unit size (27.9%), and the removal of tar, nicotine and carbon monoxide information (26.7%) on packaging. Cross-country differences were observed across all measures, with noticing all pack changes markedly lower in Spain than the other countries. Correlates of noticing specific pack changes included sociodemographic characteristics, smoking behaviours and related to packaging. **Conclusions:** This is one of the first cross-country studies to examine the extent to which TPD changes to cigarette and RYO tobacco packaging are being noticed by smokers and recent quitters. Findings indicate that the majority of smokers noticed at least one type of pack change, but this varied across countries and sub-populations.

## Introduction

Cigarette packaging is a key tool in the tobacco industry's marketing strategy.<sup>1</sup> The tobacco industry exploits all packaging elements, including pack construction, graphic design and use of colour, to increase the appeal of tobacco.<sup>2</sup> Tobacco industry internal documents reveal the extensive consumer research and deliberation in designing innovative and creative cigarette packs to increase cigarette appeal, reinforce brand imagery, target specific populations and influence perceptions about product characteristics such as the strength, quality and taste of the cigarettes inside the package.<sup>1,3</sup> To this end, the cigarette pack further evolved as a vehicle for conveying perceptions of reduced harm.<sup>1</sup> Beyond descriptive words (e.g. 'light', 'low tar' and 'mild') and lighter colour schemes,<sup>4-6</sup> the pack size, shape and opening style have also been used strategically to manipulate consumer beliefs that certain products have lower health risks.<sup>1,3</sup> Innovative structural design of cigarette packs such as novel opening mechanisms has been found to be particularly appealing to young adults,<sup>3,7</sup> while 'slim' and lipstick-shaped packs have attracted female consumers.<sup>8</sup> Moreover, alternative pack shapes and openings can impact harm perceptions by distracting from health warning labels.<sup>7</sup> Conversely, packaging can also be a tool for public health; combined pictorial and text warnings that cover at least 50% of the pack are effective in communicating information about the health risks of smoking and encouraging smokers to quit.<sup>6,9</sup>

In response to the overwhelming evidence on the influence of pack design and pictorial health warnings on consumer appeal and risk perceptions, the revised European Tobacco Products Directive (TPD), which entered into force on 19 May 2014, with an implementation date of May 2016, expanded regulations on cigarettes and roll-your-own (RYO) tobacco packaging design with the aim to decrease misperceptions of harmfulness while making health warnings more salient.<sup>10</sup> Specifically, some of the required pack changes were (i) combined text and (graphic) pictorial health warnings that cover 65% of the principal pack display area (front and back); (ii) removal of any information on labels about the tar, nicotine or carbon monoxide (TNCO) content of the tobacco product; (iii) banning packs resembling a food or cosmetic product; (iv) a minimum of 20 cigarettes in a unit packet of cigarettes, and a minimum of 30 g of tobacco in a unit packet of RYO tobacco; and (v) standardizing the pack opening mechanism to either a flip-top lid or a shoulder box with a hinged lid.<sup>10</sup> [Supplementary table S1](#) describes the tobacco packaging parameters of six European Union (EU) Member States (MS) in the EUREST-PLUS (European Regulatory Science on Tobacco: Policy implementation to reduce lung diseases) study before and after the TPD.

The EU TPD aligns with, and exceeds, the required provisions of Article 11 of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC), an international health treaty which calls upon Parties to adopt and implement effective packaging and labelling measures.<sup>11</sup> The WHO FCTC specifies measures for preventing packaging and labelling that is misleading or deceptive about the tobacco product's characteristics, health effects, hazards or emissions (i.e. low tar). It also recommends rotating health warnings and messages that cover at least 30% (but ideally 50% or more) of the principal display areas on both the front and back of the pack, and which can include pictures or pictograms.<sup>11</sup>

Few studies have evaluated the impact of TPD packaging changes, with most being either experimental studies<sup>12</sup> or population-level studies among countries that had implemented plain packaging legislation alongside the TPD.<sup>13</sup> The aim of the current study was to examine the extent to which smokers and recent quitters in six EU countries (Germany, Greece, Hungary, Poland, Romania and Spain) reported noticing TPD-related changes to tobacco product packaging and correlates of noticing these changes, as a prerequisite for subsequent changes in smoking behaviour.

## Methods

The current study is part of the Horizon 2020-funded EUREST-PLUS project (EUREST-PLUS-HCO-06-2015). The overall objective of EUREST-PLUS is to monitor and evaluate the impact of tobacco control policies at the European level within the context of the newly implemented TPD and the WHO FCTC.<sup>14</sup> A major aim of EUREST-PLUS is to evaluate the psychosocial and behavioural impacts of the TPD and WHO FCTC implementation, through the creation of an International Tobacco Control Policy Evaluation (ITC) Project cohort study using a pre- vs. post-TPD implementation study design (Wave 1 in 2016 and Wave 2 in 2018). Data for the current analysis come from Wave 2 of the ITC 6 European study (ITC-6E), which was from February to May 2018 among 6027 smokers and recent quitters (those who self-reported quitting smoking between Wave 1 and Wave 2) from six EU MS (Germany  $n = 1010$ ; Greece  $n = 1010$ ; Hungary  $n = 1000$ ; Poland  $n = 986$ ; Romania  $n = 1003$ ; Spain  $n = 1008$ ).<sup>15</sup> Smoking prevalence<sup>14</sup> and tobacco price per standard cigarette pack or RYO equivalent<sup>16</sup> for each country are reported elsewhere. The primary outcomes of interest of the current study (noticing pack changes) were only measured in Wave 2, thereby precluding longitudinal analysis.

### Design

Wave 2 respondents comprised both respondents who completed the Wave 1 survey and were re-contacted to participate in the follow-up survey (regardless of their smoking status at Wave 2), as well as replenishment respondents to replace Wave 1 respondents who were not successfully re-contacted. Respondents at the time of initial contact were adult cigarette smokers (18+ years old) recruited via multi-stage stratified random sampling. Interviews were conducted face-to-face by interviewers using tablets (computer-assisted personal interviews). The study was approved by the Office of Research Ethics at the University of Waterloo, Canada, and by local ethics boards in the participating countries. Further details about the study methodology are provided elsewhere.<sup>15,17</sup>

### Measures

The conceptual model of all ITC Surveys, which is based on psychosocial behavioural theories,<sup>18</sup> guided the selection of questions in the ITC-6E Survey. Policy-specific variables in the current study, specifically as they relate to noticing TPD-related pack design changes, were developed to align with the provisions of the TPD.<sup>10</sup> The conceptual model of the ITC Project theorizes that there is a causal pathway through which policy-specific variables may impact behaviour, directly or through different mediational models.<sup>18</sup> In the context of the current study, we theorize that 'noticing a change' in packaging is a precursor to policy-specific effects, such as a decrease in misperceptions about the harms of smoking.<sup>19</sup> This in turn can impact attitudes and outcome expectancies that influence behavioural intentions, which in turn affects outcome behaviours, such as quitting.<sup>18,20</sup>

### Noticing TPD pack design changes to cigarettes or RYO tobacco

The primary outcome measures of noticing TPD pack design changes were evaluated by the questions, 'Over the last 12 months have you noticed any of the following changes to cigarettes or RYO tobacco ... a change in the type of health warnings on the pack?; the removal of TNCO information from the pack?; that the minimum size of tobacco product packages is now 20 cigarettes/30 g of RYO tobacco?; that packages no longer resemble food or cosmetic products (lipstick packs)?; and that all packs now have a standard, flip top or side-hinge opening?' (yes, no, don't know). 'Don't know' and 'no' responses were coded as 'did not notice change' and 'yes' responses were coded as 'noticed change'. In addition, a 'noticing

any change' outcome was defined by reporting having noticed at least one pack design change.

### Demographic characteristics

Demographic characteristics examined were age (18–24, 25–39, 40–54 and ≥55 years); gender (male, female); degree of urbanization (urban, intermediate, rural); highest level of formal education completed, categorized as low (primary; lower pre-vocational secondary, middle pre-vocational secondary), moderate (secondary vocational; senior general secondary and pre-university) and high (higher professional and university bachelor, university master); and monthly gross household income, categorized as low (<€1750 for Germany, Greece and Spain, ≤150 000 Ft for Hungary, ≤2000 zł for Poland, ≤1000 lei for Romania), moderate (€1750–€3000, 150 001–250 000 Ft, 2001–4000 zł, 1001–2500 lei) and high (>€3000, >250 000 Ft, >4000 zł, >2500 lei).

### Smoking behaviours

Recontact respondents from Wave 1 were asked, 'Do you still smoke cigarettes or have you quit?' (still smoke cigarettes, quit). Those reporting having quit cigarettes since last surveyed were categorized as 'recent quitters'. Among current smokers, smoking behaviour measures examined were smoking status (daily smoker, non-daily smoker); type of cigarette product used (exclusively RYO tobacco, exclusively factory-made [FM] or both RYO and FM); nicotine dependence (Heaviness of Smoking Index,<sup>21</sup> coded as low [0–1], moderate [2–4] and high [5–6]); and whether a smoking quit attempt had been made in the last 18 months (yes, no).

### Perceptions of cigarette and RYO tobacco pack design and harmfulness

Respondents' perceptions of cigarette and RYO tobacco pack design were assessed by the questions: 'To what extent do you like the look of your cigarette pack?' and 'To what extent does seeing your cigarette pack lead you to think about the pleasure you will get from smoking your next cigarette?' (not at all, a little, somewhat, quite a lot, very much). Respondents were also asked 'When you look at a cigarette pack, what do you usually notice first—the warning labels, or other aspects of the pack such as branding?' (warning labels, other aspects of the pack such as branding/don't know).

Questions related to the degree to which pack design indicates information about harmfulness and taste included: 'To what extent do words on the pack like 'Smooth', 'Slim' or 'Silver' indicate how harmful the cigarettes are compared with others?'; 'To what extent do the colours of the pack itself indicate how harmful the cigarettes are compared with others?'; and 'To what extent does the tar and nicotine levels of the brand give you useful information on how cigarettes will taste?' (not at all, a little, somewhat, a lot). Respondents were further asked, 'In the last 30 days, how often did you think about the harm your smoking might be doing to you/think about the harm your smoking might have been doing to you if you were still smoking?' (never, rarely, sometimes, often, very often).

Lastly, perceptions related to usual/current brand included: 'Based on your experience of smoking, do you think that your usual/current/former brand you smoke/smoked is a little less harmful, no different or a little more harmful, compared with other cigarette brands?' (a little less harmful, no different, a little more harmful) and 'Thinking about the cigarettes you usually smoke/are currently smoking compared with other cigarettes, are your cigarettes harsher or smoother on your throat?' (harsher, about the same, smoother).

### Analysis

Bivariate and logistic regression analyses of weighted data were conducted using SAS-callable SUDDAN. Logistic regression models were restricted to the subset of current smokers and controlled for sex, age group, country, residence (urban/intermediate/rural), income, education, smoking status (daily vs. non-daily smoker) and type of cigarettes smoked (FM/RYO/both). Regression models also controlled for whether smokers noticed warning labels first, whether they liked the look of their cigarette pack, whether they believed tar/nicotine information on packs provides information about taste, whether the pack leads to thoughts of pleasure, whether they believed their brand is less harmful than others and whether they believed their brand to be smoother or harsher than others. We adjusted for a large number of variables given the exploratory nature of the analyses and the limited literature on factors associated with noticing specific changes in tobacco packaging. For the following covariates 'don't know' responses were coded as missing: liking the look of the pack ( $n = 184$  missing); tar/nicotine provides info about taste ( $n = 142$ ); pack provides pleasure ( $n = 109$ ); harmfulness of brand compared with others ( $n = 138$ ); and smoothness/harshness of brand compared with others ( $n = 115$ ). For all variables in the model, refusals to answer (which rarely occurred) were also coded as missing. Missing data were handled via listwise deletion. All  $P$ -values reported are two-tailed. All statistical tests and confidence intervals were corrected for the complex sample design.

### Ethics review

For the ITC 6E Survey, study procedures and material including the survey questionnaire were approved by the ethics research committee at the University of Waterloo (ON, Canada), and ethics committees in Germany (Ethikkommission der Medizinischen Fakultät Heidelberg), in Greece (Medical School, University of Athens—Research and Ethics Committee), in Hungary (Medical Research Council—Scientific and Research Committee), in Poland (State College of Higher Vocational Education—Committee and Dean of the Department of Health Care and Life Sciences), in Romania (Iuliu Hatieganu University of Medicine and Pharmacy) and in Spain (Clinical Research Ethics Committee of Bellvitge, Hospital Universitari de Bellvitge, Catalonia).

## Results

### Sociodemographic characteristics and smoking behaviours of the sample

Weighted characteristics of respondents in Wave 2 are presented in [Supplementary table S1](#). The sample consisted of 6027 adults aged 18 years or older, with ~1000 respondents from each of Germany, Greece, Hungary, Poland, Romania and Spain. Overall, 89.3% of respondents were daily smokers, 4.1% non-daily smokers ( $n = 5612$  total smokers) and 6.5% recent quitters (those who were recruited as smokers in Wave 1, but who had quit by Wave 2). Just over half of respondents were recruited at Wave 1 (52.9%), 44.9% were male, and most had a moderate level of education (56.9%). Additionally, current smokers primarily used FM products exclusively (73.4%), smoked 11–20 cigarettes per day (50.5%) and were categorized as having moderate nicotine dependence based on the Heaviness of Smoking Index (70.6%).

### Prevalence of noticing TPD changes to cigarette or RYO pack design changes

Overall, 56% of respondents reported noticing any one change in the pack design, ranging from 78.8% in Greece to 22.7% in Spain. For specific pack change measures, 30% reported noticing changes to the type of health warnings, 27.7% to the standardized opening mechanism (that packs now have a standard, flip top or side-hinge

**Table 1** Awareness of the EU Tobacco Products Directive pack design changes to boxed cigarettes/RYO tobacco among smokers and former smokers (ITC 6 European Country Survey Wave 2, weighted)

	Germany			Greece			Hungary			Poland			Romania			Spain			Overall			
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI	P
Noticed a change in health warning type on pack	235	24.0	18.8–30.1	425	43.4	35.9–51.2	290	29.9	24.4–36.1	441	42.6	36.7–48.7	282	28.0	24.3–32.1	134	12.5	8.8–17.4	1807	30.0	27.8–32.4	<0.001
Noticed the removal of tar, nicotine and carbon monoxide information	235	24.3	18.2–31.5	437	42.8	36.3–49.6	241	24.9	20.2–30.4	250	26.2	21.6–31.5	348	37.2	31.2–43.7	69	4.9	3.4–6.8	1580	26.7	24.5–29.0	<0.001
Noticed minimum pack size is now 20 cigarettes in a pack or 30 g for RYO	277	27.1	22.2–32.7	493	50.8	44.1–57.5	305	30.9	26.0–36.2	215	22.3	17.6–27.7	219	22.7	18.9–27.1	82	8.4	5.4–12.8	1591	27.1	25.0–29.2	<0.001
Noticed packages no longer resemble food/cosmetic product	97	10.5	7.5–14.7	196	19.3	15.0–24.5	224	23.8	19.4–28.8	254	26.3	21.1–32.1	276	28.8	24.1–34.0	37	4.1	1.9–7.6	1084	18.7	17.0–20.6	<0.001
Noticed that all packs now have a standard opening	309	29.7	24.0–36.1	252	24.4	19.8–29.7	258	26.3	21.8–31.4	391	38.3	31.7–45.4	362	38.7	33.1–44.6	103	10.1	6.9–14.5	1675	27.9	25.7–30.1	<0.001
Noticed any one of the pack changes	576	57.6	50.1–64.8	779	78.8	73.7–83.2	538	55.1	49.0–61.1	623	62.8	55.4–69.6	590	61.5	55.5–67.2	242	22.7	17.4–29.2	3348	56.4	53.8–58.9	<0.001

opening), 27.9% to the minimum pack size (20 cigarettes/30 g RYO) (27.9%), 26.7% to the removal of TNCO information and 18.7% to packs no longer resembling food/cosmetic products. All of these measures varied significantly across countries ( $P < 0.001$ ) (table 1).

Table 2 presents the percentages of respondents who reported noticing pack design changes stratified by demographic characteristics and smoking behaviours. Across all pack design measures, a greater percentage of current smokers noticed changes than former smokers, with 58.2% of current smokers noticing at least one pack change compared with 30.8% of recent quitters ( $P < 0.001$ ). All pack measures were also related to income, but with no clear pattern other than those who declined to report their income were less likely to have noticed each of the changes.

Table 3 presents the percentages of respondents who noticed pack design changes stratified by perceptions. Respondents who reported ‘noticing warning labels first’ compared with ‘noticing other aspects of the pack first’ were more likely to report noticing all of the pack design changes, except for ‘minimum size’. The perceptions that the pack elements of colour and text indicate relative harmfulness were both related to noticing the new health warnings, that packs no longer resembled food/cosmetic products and standardized openings, all with an element of dose–response. Reporting that TNCO provides useful information about taste was associated with noticing each of the pack design changes. Recent thoughts about the harm to self from smoking were associated with reporting noticing all types of pack changes, except for the removal of TNCO information.

### Correlates of noticing changes to pack design

Correlates of noticing each of the pack design changes among the subset of current smokers from multivariable logistic regression analyses are shown in table 4. Gender, degree of urbanization and wave of recruitment were not associated with noticing any of the pack changes. Country was significantly related to noticing each of the changes, with respondents in Spain considerably less likely to report having noticed the changes than those in the other five countries, holding all other factors constant. Compared with respondents in Greece, all other countries had lower odds of noticing the removal of TNCO information, minimum pack size and any one change overall. Respondents in Romania had the highest odds of noticing that packs no longer resembled food/cosmetics (OR = 1.83, 95% CI = 1.19–2.80 compared with Greece).

Aside from country, no other measure was significantly associated with noticing each pack design change. However, there were a number of significant correlates of reporting noticing specific pack changes.

### Noticing a change in health warning type

Correlates of noticing a change in health warnings included noticing warning labels prior to other aspects of the pack (OR = 1.58, 95% CI = 1.25–1.99), and reporting that TNCO provides useful information on taste ‘somewhat/a lot’ (OR = 1.46, 95% CI = 1.20–1.78 compared with ‘not at all/a little’).

### Noticing the removal of TNCO information

Compared with those aged 55+, younger respondents had greater odds of noticing the removal of TNCO information, with the greatest odds among those aged 18–24 (OR = 1.57, 95% CI = 1.13–2.17). Daily smokers and exclusive FM users also had greater odds of noticing this change (OR = 1.68, 95% CI = 1.06–2.66 compared with non-daily smokers and OR = 1.39, 95% CI = 0.97–1.99 compared with users of both RYO and FM). Respondents with low-income levels and those who did not report income had lower odds of noticing the removal of TNCO information (OR = 0.59, 95% CI = 0.44–0.80 and OR = 0.78, 95% CI = 0.58–0.98,

**Table 2** Percentage of smokers and former smokers who noticed EU Tobacco Products Directive pack design changes to cigarettes/RYO tobacco by demographic characteristics and smoking behaviours (ITC 6 European Country Survey Wave 2, weighted)

	Health warnings			Removal of TNCO information			Minimum pack size			Packs do not resemble food/cosmetics			Packs have a standard opening			Any one change			
	n/N	%	95% CI	n/N	%	95% CI	n/N	%	95% CI	n/N	%	95% CI	n/N	%	95% CI	n/N	%	95% CI	P
Sex																			
Male	902/3077	29.5	27.0-32.2	811/3077	26.9	24.4-29.5	797/3075	26.4	24.1-29.0	530/3067	18.4	16.4-20.7	802/3075	27.1	24.6-29.7	1669/3072	55.4	52.4-58.3	
Female	905/2932	30.7	28.1-33.6	769/2927	26.5	23.8-29.3	794/2924	27.8	25.4-30.4	554/2918	19.2	17.1-21.4	873/2926	28.9	26.5-31.4	1679/2924	57.7	54.7-60.7	
Age group (years)																			
18-24	143/457	28.8	24.2-33.9	128/456	27.8	23.3-32.8	118/458	22.8	18.5-27.8	86/458	19	14.9-23.8	131/456	28.4	23.7-33.5	251/456	51	45.5-56.6	*
25-39	530/1645	31.9	28.7-35.3	454/1645	28.9	25.8-32.2	467/1642	29.2	26.2-32.3	297/1637	19.3	16.8-22.1	467/1642	28.4	25.3-31.8	950/1641	59.6	55.9-63.1	
40-54	628/2088	30	27.1-33.1	596/2085	28.3	25.5-31.3	577/2083	27.4	24.6-30.4	380/2077	18.3	15.9-21.0	563/2087	27.1	24.2-30.1	1192/2085	57.1	53.8-60.4	
55+	506/1819	28.2	25.0-31.7	402/1818	21.6	18.7-24.7	429/1816	25.6	22.7-28.9	321/1813	18.5	15.8-21.6	514/1816	28.1	25.1-31.2	955/1814	53.6	49.7-57.4	
Education																			
Low	466/1895	25.1	22.1-28.3	412/1898	22.3	19.3-25.6	485/1892	25.7	23.0-28.7	296/1891	16.8	14.3-19.7	485/1895	25.3	22.3-28.4	976/1894	52.3	48.8-55.7	**
Moderate	1074/3375	31.2	28.5-34.1	940/3368	27.8	25.2-30.5	884/3370	27.1	24.6-29.7	642/3360	19	16.8-21.3	984/3367	29.2	26.5-32.1	1916/3365	57.3	54.1-60.4	
High	262/718	37.3	31.9-43.1	222/717	32.8	27.8-38.1	217/717	30.5	25.9-35.5	138/713	22.3	18.0-27.2	200/718	28.6	24.3-33.2	445/716	63.3	57.8-68.5	
Income																			
Low	282/1057	28.9	24.8-33.5	198/1057	18.9	15.9-22.4	284/1053	30	26.1-34.2	180/1054	18	14.9-21.6	312/1054	31.1	27.0-35.6	557/1054	56.1	51.6-60.5	***
Moderate	661/1955	35.1	31.4-39.0	594/1951	31	27.6-34.6	565/1955	30.1	26.8-33.6	355/1948	18.7	16.3-21.4	554/1955	28.5	25.4-31.8	1154/1950	60.3	56.7-63.9	
High	457/1331	32.1	28.2-36.2	458/1333	34.7	30.5-39.2	400/1331	29.9	26.3-33.8	284/1324	22.7	19.4-26.3	436/1331	33.1	29.2-37.3	870/1332	65.2	60.4-69.7	
Not reported	407/1666	23.6	20.5-26.9	330/1663	19.9	16.8-23.3	342/1660	19.8	16.9-23.1	265/1659	16	13.1-19.4	373/1661	21.1	18.0-24.6	767/1660	45.2	40.9-49.5	
Smoking status																			
Daily smoker	1672/5361	31	28.6-33.6	1482/5357	28	25.7-30.5	1485/5351	28.2	26.1-30.5	999/5337	19.2	17.4-21.3	1538/5354	28.6	26.4-31.0	3090/5348	58.2	55.5-60.9	***
Non-daily smoker	68/236	29.8	22.1-38.7	49/235	19.8	13.4-27.7	62/235	26	19.5-33.7	43/236	20	13.3-28.2	75/234	30.5	23.8-38.2	135/236	57.8	50.1-65.1	
Former smoker	67/412	16.8	12.6-22.1	49/412	12.5	8.4-17.7	44/413	11.6	7.9-16.1	42/412	11.1	7.2-16.2	62/413	15.5	11.3-20.9	123/412	30.8	25.1-37.0	
Type of cigarette																			
FM only	1331/4176	31.4	28.9-34.1	1233/4172	30	27.4-32.7	1024/4168	25	22.7-27.3	787/4156	19.6	17.6-21.8	1272/4168	30.5	28.0-33.1	2429/4164	58.9	56.0-61.7	
RYO only	306/1036	31.1	26.8-35.8	227/1035	22.3	18.4-26.8	400/1034	38.5	34.2-42.9	187/1034	18.4	15.1-22.4	208/1035	20	16.7-23.7	579/1035	57.1	52.6-61.4	
Both	102/382	26	20.7-32.2	70/382	19.3	14.6-24.9	122/381	33.1	27.1-39.8	67/380	18.3	13.9-23.7	132/382	33.3	27.1-40.1	216/382	54.6	47.1-61.9	
Nicotine dependence HSI																			
Low	389/1171	33.5	29.3-38.1	323/1167	27.7	24.0-31.7	311/1167	27.5	23.9-31.3	220/1163	20	16.6-24.0	338/1167	28.1	24.3-32.3	673/1167	58	53.0-62.9	
Moderate	1149/3752	30.8	28.2-33.5	1027/3750	27.8	25.3-30.5	1040/3746	28.3	25.9-30.8	705/3740	19.6	17.5-21.8	1082/3750	29.4	27.0-31.9	2166/3745	58.6	55.8-61.3	
High	124/413	26.5	21.4-32.3	124/415	30.5	23.8-38.1	128/414	30.1	24.8-36.1	66/411	13.8	10.2-18.3	110/412	24.1	18.9-30.1	236/411	55.6	48.2-62.8	
Quit attempt in last 18 months																			
Made a quit attempt	421/1414	30.3	26.9-34.0	338/1413	26.2	22.9-29.8	348/1413	26.2	22.9-29.7	273/1408	20.7	17.7-24.2	407/1414	29.6	26.0-33.5	726/1412	53.1	49.1-57.1	*
Did not	1386/4595	30	27.5-32.6	1242/4591	26.8	24.4-29.4	1243/4586	27.3	25.1-29.6	811/4577	18.1	16.3-20.2	1268/4587	27.3	25.1-29.7	2622/4584	57.4	54.6-60.2	

\*: *P* < 0.05; \*\*: *P* < 0.01; \*\*\*: *P* < 0.001.



**Table 4** Correlates of noticing European Union Tobacco Products Directive pack design changes to cigarettes/RYO tobacco among smokers (ITC 6 European Country Survey Wave 2, weighted)

	Health warnings		Removal of TNCO information		Minimum pack size		Packs do not resemble food/ cosmetics		Packs have a standard opening		Any one change	
	OR (95% CI)	P	(n = 5068) OR (95% CI)	P	(n = 5060) OR 95% CI)	P	(n = 5050) OR (95% CI)	P	(n = 5061) OR (95% CI)	P	(n = 5059) OR (95% CI)	P
Gender (ref = male)												
Female	1.03 (0.90–1.18)		1.01 (0.87–1.17)		1.04 (0.88–1.21)		1.05 (0.89–1.25)		1.11 (0.97–1.27)		1.07 (0.93–1.24)	
Age group (ref = 55+) (years)												
18–24	1.21 (0.88–1.65)	***	1.57 (1.13–2.17)	***	1.00 (0.72–1.40)		1.06 (0.73–1.54)		1.15 (0.86–1.54)		1.07 (0.79–1.46)	*
25–39	1.20 (0.93–1.47)		1.48 (1.18–1.85)		1.22 (0.97–1.53)		1.07 (0.82–1.39)		1.13 (0.92–1.40)		1.33 (1.08–1.65)	
40–54	1.18 (0.97–1.43)		1.50 (1.22–1.85)		1.17 (0.94–1.44)		1.09 (0.86–1.39)		1.10 (0.90–1.35)		1.34 (1.09–1.63)	
Country (ref = Greece)												
Germany	0.49 (0.31–0.77)	***	0.47 (0.30–0.76)	***	0.39 (0.24–0.61)	***	0.56 (0.33–0.93)	***	1.34 (0.86–2.07)	***	0.43 (0.27–0.67)	***
Hungary	0.63 (0.39–1.00)		0.42 (0.28–0.64)		0.42 (0.27–0.64)		1.55 (0.97–2.48)		1.39 (0.91–2.12)		0.34 (0.21–0.53)	
Poland	1.08 (0.70–1.67)		0.44 (0.29–0.67)		0.27 (0.17–0.42)		1.54 (0.95–2.50)		1.91 (1.21–3.00)		0.49 (0.30–0.79)	
Romania	0.50 (0.33–0.76)		0.63 (0.42–0.96)		0.29 (0.19–0.44)		1.83 (1.19–2.80)		1.81 (1.20–2.73)		0.39 (0.25–0.62)	
Spain	0.24 (0.14–0.41)		0.06 (0.04–0.10)		0.10 (0.05–0.17)		0.19 (0.10–0.39)		0.39 (0.22–0.67)		0.09 (0.05–0.15)	
Degree of urbanization (ref = rural)												
Urban	1.03 (0.75–1.41)		0.96 (0.70–1.33)		1.15 (0.83–1.60)		1.39 (0.99–1.95)		1.33 (0.96–1.85)		1.23 (0.91–1.67)	
Intermediate	0.92 (0.67–1.27)		1.10 (0.87–1.39)		0.94 (0.70–1.26)		1.18 (0.83–1.67)		1.24 (0.89–1.72)		1.14 (0.84–1.54)	
Wave of recruitment (ref = wave 2)												
Wave 1	1.04 (0.83–1.29)		1.10 (0.87–1.39)		1.11 (0.89–1.39)		1.03 (0.81–1.30)		1.26 (0.99–1.59)		1.11 (0.89–1.38)	
Income (ref = high)												
Not reported	0.79 (0.59–1.04)	**	0.78 (0.58–0.98)	***	0.78 (0.59–1.04)		0.98 (0.71–1.35)		0.83 (0.61–1.13)		0.72 (0.55–0.95)	
Low	1.11 (0.81–1.51)		0.59 (0.44–0.80)		1.13 (0.85–1.51)		1.21 (0.89–1.64)		1.19 (0.88–1.62)		0.90 (0.68–1.20)	
Moderate	1.25 (0.98–1.59)		1.00 (0.80–1.25)		0.95 (0.76–1.18)		1.03 (0.80–1.35)		0.98 (0.78–1.24)		0.86 (0.67–1.09)	
Education (ref = high)												
Low	0.71 (0.52–0.96)		0.74 (0.56–0.98)	*	0.77 (0.57–1.04)	*	0.82 (0.57–1.18)		0.94 (0.69–1.28)		0.71 (0.54–0.93)	*
Moderate	0.85 (0.65–1.11)		0.88 (0.69–1.12)		0.99 (0.77–1.28)		0.88 (0.63–1.22)		1.03 (0.79–1.36)		0.83 (0.64–1.08)	
Smoking status (ref = non-daily)												
Daily smoker	1.07 (0.68–1.68)		1.68 (1.06–2.66)		1.06 (0.67–1.32)		0.74 (0.47–1.16)		1.01 (0.71–1.45)		1.00 (0.70–1.42)	
FM/RYO (ref = both)												
FM only	1.20 (0.84–1.72)	*	1.39 (0.97–1.99)	*	0.50 (0.37–0.68)	***	0.96 (0.66–1.41)	***	0.91 (0.66–1.24)	***	1.01 (0.74–1.38)	
RYO only	1.25 (0.86–1.81)		0.99 (0.64–1.52)		0.94 (0.67–1.32)		1.00 (0.67–1.50)		0.62 (0.45–0.84)		1.06 (0.77–1.46)	
Notice warning labels first (ref = other aspects/don't know)												
Warning labels	1.58 (1.25–1.99)	***	1.66 (1.32–2.07)	***	1.43 (1.12–1.82)	**	1.47 (1.15–1.88)	**	1.25 (0.99–1.57)		1.61 (1.28–2.03)	***
Like look of pack (ref = otherwise)	1.18 (0.95–1.47)		1.07 (0.86–1.34)		1.11 (0.87–1.41)		1.09 (0.87–1.36)		1.00 (0.80–1.25)		1.11 (0.90–1.37)	
Tar/nicotine info provides on taste (ref = not at all/a little)												
Somewhat/a lot	1.46 (1.20–1.78)	***	1.40 (1.13–1.74)	**	1.22 (1.00–1.48)	*	1.17 (0.92–1.49)		1.17 (0.95–1.44)		1.47 (1.22–1.76)	***
Pack brings pleasure (ref = otherwise)												
A lot	0.90 (0.65–1.25)		0.91 (0.68–1.22)		1.21 (0.91–1.61)		0.87 (0.61–1.23)		1.42 (1.08–1.86)	*	1.02 (0.76–1.38)	
Own brand is less harmful (ref = same)												
More harmful	1.12 (0.73–1.71)		0.90 (0.58–1.42)		1.33 (0.83–2.15)		1.33 (0.81–2.19)		1.16 (0.74–1.80)	*	1.36 (0.91–2.02)	
Less harmful	1.01 (0.79–1.29)		1.18 (0.92–1.51)		1.03 (0.81–1.32)		0.93 (0.71–1.21)		1.37 (1.10–1.70)		0.97 (0.78–1.21)	
Relative smoothness of usual brand (ref = same)												
Smother	1.11 (0.91–1.36)		1.04 (0.85–1.27)	***	1.50 (1.23–1.83)	**	1.41 (1.13–1.76)	**	1.30 (1.07–1.58)	***	1.62 (1.34–1.95)	***
Harsher	1.18 (0.82–1.68)		1.42 (1.00–2.02)		1.56 (1.01–2.43)		1.35 (0.91–1.99)		1.58 (1.17–2.12)		1.87 (1.37–2.55)	

\*: P < 0.05; \*\*: P < 0.01; \*\*\*: P < 0.001



respectively, compared with high income). Additional correlates of noticing the removal of TNCO information included noticing warning labels first (OR = 1.66, 95% CI = 1.32–2.07 compared with other aspects of the pack) and believing that TNCO information provides useful information about taste (OR = 1.40, 95% CI = 1.13–1.74 ‘somewhat/a lot’ compared with ‘not at all/a little’).

### Noticing minimum pack size

Those with low education levels and exclusive FM users had lower odds of noticing that packs now have a minimum size (OR = 0.77, 95% CI = 0.59–1.04 compared with high income and OR = 0.50, 95% CI = 0.37–0.68 compared with users of both RYO and FM). Respondents who reported perceiving that their usual brand is either smoother or harsher than other brands had higher odds of noticing a change to the minimum pack size (OR = 1.50, 95% CI = 1.23–1.83 ‘smoother’ and OR = 1.56, 95% CI = 1.01–2.43 ‘harsher’ compared with ‘the same’). Other correlates of noticing this change included noticing warning labels first (OR = 1.43, 95% CI = 1.12–1.82) and the belief that TNCO provides useful information on taste (OR = 1.22, 95% CI = 1.00–1.48 ‘somewhat/a lot’ compared with ‘not at all/a little’).

### Noticing packs no longer resemble food/cosmetics

Respondents who reported perceiving that their usual brand is smoother than other brands had greater odds of noticing that packs no longer resembled food/cosmetics (OR = 1.41, 95% CI = 1.13–1.76 compared with ‘the same’). Noticing warning labels first was also correlated with noticing this change (OR = 1.47, 95% CI = 1.15–1.88).

### Noticing standardized pack opening

Exclusive RYO users had lower odds of noticing that all packs now have a standardized opening (OR = -0.91, 95% CI = 0.66–1.24 compared with users of both RYO and FM). Those who reported that seeing the pack triggers thoughts about the pleasure of smoking the next cigarette also had greater odds of noticing this change (OR = 1.42, 95% CI = 1.08–1.86 ‘a lot’ compared with otherwise). Moreover, noticing the standardized pack opening was correlated with perceiving one’s own brand to be less harmful (OR = 1.37, 95% CI = 1.10–1.70 compared with ‘the same’) and to be smoother (OR = 1.30, 95% CI = 1.07–1.58) or harsher (OR = 1.58, 95% CI = 1.17–2.12) than other brands.

### Noticing any one pack design change

Respondents aged 25–39 or 40–54 had greater odds of noticing any pack design change as compared with those aged 55+ (OR = 1.33, 95% CI = 1.08–1.65 and OR = 1.34, 95% CI = 1.09–1.63, respectively). Those with low levels of education had lower odds of noticing any pack design change (OR = 0.70, 95% CI = 0.55–0.90 compared with high education). Additional correlates of noticing any one pack design change included: noticing warning labels first (OR = 1.61, 95% CI = 1.28–2.03 compared with other aspects of the pack), believing that TNCO provides useful information on taste (OR = 1.47, 95% CI = 1.22–1.76 ‘somewhat/a lot’ compared with ‘not at all/a little’), as well as perceiving one’s own brand to be either ‘smoother’ (OR = 1.62, 95% CI = 1.34–1.95) or ‘harsher’ (OR = 1.87, 95% CI = 1.37–2.55) than other brands.

## Discussion

The current study examines cross-sectional data on the extent to which smokers and recent quitters from six EU countries reported noticing changes to cigarettes or RYO tobacco pack design after implementation of the TPD. Overall, more than half of smokers

and more than one-quarter of recent quitters reported noticing at least one of five types of pack design changes. The overall prevalence of reporting noticing each of the individual pack changes differed significantly across countries and sub-populations. As found in previous studies, awareness was highest among current smokers compared with former smokers, likely explained by greater exposure.<sup>13</sup> Along this same logic, low awareness of specific pack changes, such as that packs no longer resemble food/cosmetics, may be related to whether respondents were previously using a pack with that feature.

Respondents from Spain had significantly lower odds of noticing the pack changes compared with those in all other countries. Cross-country differences in noticing pack changes may be explained by several factors, including differential timelines in TPD implementation, the country-specific features of cigarette and RYO packaging design on the market prior to the TPD and consumer preferences regarding the influence of cigarette packaging design on reasons for smoking initiation,<sup>22</sup> brand loyalty<sup>23</sup> and perceptions around packaging.<sup>23,24</sup> For instance, in the ITC 6E Wave 1 Survey, prior to TPD implementation, smokers who reported choosing a specific cigarette brand based on the tar and nicotine levels of the brand and based on the look and feel of the pack were least likely to be from Spain and more likely to be from Greece and Romania.<sup>23</sup> Pre-TPD packaging requirements may also partly explain country variation, with smokers in countries that had more drastic changes to packaging noticing changes more, a phenomenon known as ‘contrast effect’ which has been reported in other cross-country comparisons of the impact of changes in health warnings.<sup>25</sup> For instance, the odds of smokers’ noticing a change in the type of health warnings were greatest in Greece and Poland, where pre-TPD packages had text warnings only. In these countries, the switch to graphic health warnings may therefore have been more salient than in countries where picture-based warnings were in effect prior to the TPD, such as Hungary, Romania and Spain. However, this was not found in Germany which also switched from text warnings only. Other country-specific smoking factors may also explain why Greece had the highest odds of noticing packaging changes. For example, as compared with all other countries in the current study, Greece has the highest overall smoking prevalence<sup>14</sup> and the highest rates of smoking in public places in all types of settings (workplaces, restaurants, bars/pubs and discos), which offers more opportunities for exposure to cigarette packages.<sup>26,27</sup> In a similar light, it is also plausible that country-specific awareness of changes may be explained by a more dominant presence of these pack features in the pre-TPD market.

No consistent pattern of sociodemographic associations with noticing different types of packaging changes was observed, precluding clear conclusions. Similarly, another European ITC cohort study concluded a neutral equity impact of pictorial warning labels among continuing smokers.<sup>28</sup> Further research, particularly using cohort data, is needed to elucidate the equity impact of EU TPD packaging regulations.<sup>28</sup>

Findings further suggest that perceptions towards packaging and labelling may also influence whether a pack change is noticed. For instance, those who reported that TNCO information provides useful information about taste had significantly greater odds of reporting noticing the removal of TNCO information. Misperceptions about brands’ relative harmfulness (i.e. perceptions that one’s own brand is less/more harmful or smoother/harsher compared with others) were also positively associated with noticing certain pack design changes. It is plausible that respondents who are influenced by packaging features in forming perceptions about taste and relative harmfulness may have noticed pack changes more due to having sought cues on packaging to

indicate such features, or due to a heightened awareness of packaging more generally.

It is important to note that low awareness of specific pack changes does not necessarily imply that changes are not having an impact. Evidence suggests that graphic warning labels may impact smoking behaviours and attitudes implicitly (outside of conscious awareness) even contrary to self-reported explicit outcomes.<sup>29</sup> Furthermore, a primary target of the TPD, including pack design provisions, is preventing smoking initiation among non-smoking youth,<sup>10</sup> a group outside of the scope of the current study, which only included adult smokers and recent quitters aged 18 years and older.

The WHO FCTC<sup>11</sup> proposes that Parties should consider adopting plain packaging, which may increase the noticeability and effectiveness of health warnings, while further reducing misperceptions about product harmfulness.<sup>19</sup> As more EU countries adopt plain packaging measures, such as Hungary, it is critical to continue to monitor and contribute to the developing evidence base of tobacco packaging regulation.

### Study limitations

While this study included a representative sample from six European countries and is one of the first cross-country studies to examine the prevalence of noticing TPD packaging changes, there are several limitations. Firstly, given its cross-sectional design, the current study precludes any causal interpretation of the impact of the TPD. Questions on noticing packaging changes were only asked of respondents at Wave 2 of the ITC 6E Survey,<sup>15</sup> which did not allow for an examination of cohort data. Further, all responses are self-reported, making the survey measures prone to response bias, and in particular social desirability bias, such that a respondent may not want to admit that they did not notice a specific change that was implied to have occurred. Along these lines, one should be careful in interpreting the results to keep in mind the possible distinction between 'reporting noticing changes' and actual noticing of changes. There are other moderating factors that may have influenced cross-country differences and the degree of noticing changes, such as differences in exposure to tobacco advertising, promotion and sponsorship regulations (e.g. seeing packs at the point-of-sale)<sup>30</sup> and the extent to which TPD policy changes were covered in the media; however, such an analysis was beyond the scope of the current study. As shown in [Supplementary table S1](#), there was also cross-country variation in the dates from which the new EU TPD health warning labels had to appear on all packs for sale. Another limitation that may partly explain the low levels of noticing changes is that respondents were asked to report whether they noticed pack changes in the last 12 months. However, most pack changes were implemented more than 12 months prior to the time of Wave 2 fieldwork, and respondents may have responded accordingly.

### Conclusion

This is one of the first cross-country studies to examine the extent to which TPD provisions on cigarette and RYO tobacco packaging are being noticed by smokers and recent quitters in the EU. The study uniquely explores less studied features of packaging such as minimum pack size and resemblance to cosmetic products. Regulating tobacco packaging, including requirements for larger, graphic health warnings and standardizing pack shape and opening, has been shown to be an effective tobacco control measure.<sup>7,24,31</sup> Overall, over half of smokers and 30% of recent quitters were aware of at least one type of TPD pack change. Continued monitoring and further research on how TPD-related regulatory changes influence behavioural outcomes, such as quitting, are critical to a comprehensive understanding of the impact of the EU TPD and for deriving future policy implications.

## Supplementary data

[Supplementary data](#) are available at *EURPUB* online.

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### EUREST-PLUS Consortium members:

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## Key points

- EU Tobacco Products Directive (TPD) pack design regulations aim to mitigate misperceptions around the harm of tobacco products.
- The current study examined the extent and correlates of smokers and former smokers noticing five types of TPD pack changes: graphic health warnings, removal of TNCO information, minimum pack size, bans on products resembling food/cosmetics and standardized opening mechanisms.
- Findings indicate that the majority of smokers noticed at least one type of pack change.
- Variation in noticing changes across countries and specific populations may be related to the extent to which policies had been implemented prior to the TPD and may indicate for which population groups specific regulations are having the most effect.
- Monitoring the extent to which EU TPD-related regulatory changes to tobacco product content and packaging design are being noticed by smokers after their implementation is critical to understanding their impact.

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