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Would plain packaging and health warning labels reduce smoking in the presence of informal markets? A choice experiment in Colombia

Paul Rodríguez-Lesmes [a,*], Pamela Góngora-Salazar [b,g], Emmanouil Mentzakis [c], Neil Buckley [d], Juan Miguel Gallego [a], G. Emmanuel Guindon [e], Juan Pablo Martínez [a], Guillermo Paraje [f]

[a] School of Economics, Universidad Del Rosario, Bogota DC, Colombia
[b] Nuffield Department of Population Health, University of Oxford, Oxford, United Kingdom
[c] School of Policy and Global Affairs, City, University of London, London, United Kingdom
[d] Department of Economics, York University, Toronto, Canada
[e] Centre for Health Economics and Policy Analysis, McMaster University, Ontario, Canada
[f] Business School, Universidad Adolfo Ibañez, Santiago, Chile
[g] Social Protection and Health Division, Inter-American Development Bank, Washington DC, United States

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ABSTRACT

Background: Despite progress made by many countries on the adoption of plain tobacco packaging laws over the last years, low- and middle-income countries, with a large supply of loose cigarettes via informal vendors, remain far behind.

Aim: To study the potential effectiveness of plain tobacco packaging and dissuasive cigarette sticks, via willingness-to-pay estimates, when illicit cigarette options are available.

Methods: We conducted a discrete choice experiment (DCE) in which respondents chose licit and illicit products with three attributes: packaging (standard vs. plain packaging), stick design (branded stick vs. stick with warning), and price level. The sample, collected on 12/2021, consisted of 1761 respondents from an internet panel involving smokers and nonsmokers. Conditional logit and latent class models were used to estimate the willingness-to-pay (WTP) to avoid restrictive packaging elements.

Results: Nonsmokers are willing to pay USD $5.63 for a pack of cigarettes to avoid plain packaging, which is higher than the actual commercial price of illicit cigarettes (USD $2.40). The WTP increases to USD $12.14 in the presence of illicit alternatives. Smokers are also willing to pay to avoid illicit options, which they also deem riskier, and the presence of such options increases the WTP to avoid plain packaging. However, nonsmokers do not perceive the illicit option as riskier. The dissuasive stick (stick with warning) does not affect perceptions of risk and plays a small role in terms of choice for both smokers and nonsmokers.

Conclusions: Even in the presence of illicit tobacco alternatives, plain packaging seems to be as effective in reducing the attractiveness of tobacco products in Colombia as in other countries that have already adopted it. Given conflicting results on the case for dissuasive sticks, there is a need for more research.

1. Introduction

The World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC) entered into force in 2005 and, over the years, has led more than 180 countries to adopt demand- and supply-side reduction measures to tackle the tobacco epidemic (United Nations, 2022; WHO FCTC, 2021). This includes regulation on the packing and labeling of tobacco products, as the packaging is considered one of the primary advertising channels for the tobacco industry (Wakefield et al., 2002; Ford et al., 2012; Barrientos-Gutierrez et al., 2020–01).

The FCTC has encouraged countries to adopt health-warning labels (HWLs) on tobacco product packaging and to enforce plain or standardized packaging (WHO FCTC, 2021; FCTC. Plain packaging meetings in Geneva to discuss legal challenges, 2017; Tobacco Free Kids, 2022).

* Corresponding author. Calle 12C # 4-69 111711 Bogotá, Colombia.
E-mail addresses: paul.rodriguez@urosario.edu.co (P. Rodríguez-Lesmes), pamelago@iadb.org (P. Góngora-Salazar), emmanouil.mentzakis@city.ac.uk (E. Mentzakis), nbuckley@yorku.ca (N. Buckley), juan.gallego@urosario.edu.co (J.M. Gallego), emmanuel.guindon@mcmaster.ca (G.E. Guindon), juanpablo.martinez@urosario.edu.co (J.P. Martínez), guillermo.paraje@uai.cl (G. Paraje).

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The HWLs aim to warn tobacco consumers of the harmful effects of tobacco use and should be no less than 50% of the principal display area, according to the FCTC (WHO FCTC, 2021). Plain packaging aims to eliminate the effects of advertising or promotion on the packaging and to reduce positive perceptions of smoking (Moodie and Hastings, 2010; FCTC. et al., 2013; Freeman et al., 2022). This recommendation came years after the adoption of the FCTC by WHO and is today included in the FCTC guidelines on banning of tobacco advertising, promotion, and sponsorship (FCTC. et al., 2013). According to the 2021 Global Progress Report on the convention's implementation, 98 countries have implemented mandatory HWLs on tobacco packaging, and 18 countries have adopted and enforced plain tobacco packaging laws (WHO FCTC, 2022).

Much evidence has supported the packaging and labeling regulations of tobacco products. Various panel studies in different countries, including Australia, Canada, The United States, and Mexico, have shown that HWLs help to improve knowledge about smoking risks (Evans et al., 2015; Hammond et al., 2006–06; Mutti et al., 2013; Hughes et al., 2016; Thrasher et al., 2012; Swayampakala et al., 2015; Guindon et al., 2024). Pictorial warnings seem to be more effective in deterring consumption than text-only (Noar et al., 2016). Evidence to date also suggests that illustrations of bodily harm have a greater impact on the effectiveness of packaging as a promotional vehicle, as larger warnings are more noticeable and perceived as more effective (Hammond et al., 2013; Thrasher et al., 2012; Hammond et al., 2011–07; Huang et al., 2016–05). HWLs on cigarette sticks, formally known in the literature as dissuasive cigarette sticks, have also been considered in some countries to enhance the negative impact of standardized packaging (i.e., tobacco packaging with branding elements) and respond to industry marketing strategies on cigarette sticks (Hoek et al., 2016; van Mourik et al., 2022/06). This measure can be especially relevant in low- and middle-income settings, where the practice of selling single sticks (loosies) through an informal economy is more prevalent (Stillman et al., 2014; Chang et al., 2021). Yet it is also useful for high-income countries among low socio-economic communities (Stillman et al., 2014).

In regards to plain packaging, independent studies suggest that this measure negatively affects expectations of cigarette taste and makes cigarettes less appealing compared to branded packaging (Hammond et al., 2011–07; Germain et al., 2010; Hammond et al., 2009). In Australia, the first country to introduce this measure, studies have shown that plain packaging is associated with lower smoking appeal, more support for the policy, and more urgency to quit among adult smokers (Wakefield et al., 2013; Moodie et al., 2022). In Canada, a discrete choice experiment with smoking and nonsmoking females showed a reduced demand for tobacco packaging features typically associated with standardized packaging (Kotnowski et al., 2016). The study concluded that standardized tobacco packaging has the potential to decrease demand and reduce misleading perceptions about product harm. More broadly, the literature reviews that have assessed the effectiveness of the plain packaging policy seem to support this measure as an effective tobacco cessation policy (Stead et al., 2013; Lilic et al., 2018; Drovandi et al., 2019/01). These results are likely associated with the behavioral responses triggered by the different emotions generated by the branding elements of standardized tobacco packaging (Bogliacino et al., 2015).

Despite several studies on the effectiveness of HWLs and plain packaging, various gaps in the literature remain. While simulations support adopting plain packaging in low- and middle-income countries (Alcaraz et al., 2020), there is a scarcity of research and evaluation of the potential effectiveness of these measures based on experimental data (Freeman et al., 2022; Hughes et al., 2016; Hammond et al., 2013). Studies in Brazil (White et al., 2012/09), India (Arora et al., 2013; Hughes et al., 2016), South Africa (Vellios, 2022), and Uruguay (Harris et al., 2018; Llamb et al., 2021) (the only country that has adopted plain packaging in Latin America) showed that appeal is lower in plain packaging than in branded packaging. Moreover, a study in Colombia analysed how plain packaging and HWL affect visual attention and pack preferences among smokers and nonsmokers (Sillero-Rejon et al., 2022).

In fact, it is still not fully clear how the effectiveness of HWLs and plain packaging changes when illicit tobacco products are available. Exploring this is highly important as the industry argues that plain packaging will likely increase the demand for illicit cigarettes. Few studies, however, have examined the relationship between tobacco packaging and illicit trade, as well as the relationship between tobacco packaging, illicit trade, and low- and middle-income settings. Only the South Africa study conducted the latter. (Vellios, 2022; Moodie et al., 2012; Haighton et al., 2017; Laverty et al., 2021).

Providing evidence on the value of HWLs and plain packaging to smokers and nonsmokers is particularly relevant in low- and middle-income countries, as over 80% of the world's 1.3 billion tobacco users are concentrated in these countries (World Health Organization, 2022). While tobacco-attributable deaths are projected to decline by 9% between 2002 and 2030 in high-income countries, tobacco-attributable deaths are estimated to double, from 3.4 million to 6.8 million, in low- and middle-income countries (Mathers and Loncar, 2006). In Colombia, for instance, although the prevalence of tobacco use has decreased over the last few years, 34,800 people die every year due to tobacco-related illnesses (Ministerio de Salud y Proteccion Social, 2020). The economic cost of tobacco for the country is estimated at 17 trillion Colombian pesos (COP), equivalent to 1.8% of the country's gross domestic product (GDP) (United Nations Development Programme, 2019). As street vendors are the leading distribution channel of cigarettes in Colombia, measures on single sticks are particularly relevant in the country (Maldonado et al., 2020). Since 2006, Colombia has implemented different evidence-based interventions within the WHO FCTC (e.g., increased tobacco taxes, smoke-free environments, pictorial HWLs on tobacco packaging), with a significant impact on reducing tobacco consumption in the country (Guzman-Tordecilla et al., 2022). Nevertheless, the country has not yet implemented plain packaging, a component of the WHO-FCTC, and the size of pictorial HWLs covers only 30% of the packaging's surface. There is evidence that current Colombian graphic health warnings do not generate a strong emotional response, but that larger HWLs would (Sillero-Rejon et al., 2022; Gantiva et al., 2021). In consequence, it is relevant to study how modifying current HWLs would impact risk perceptions and choices (United Nations Development Programme, 2019).

This study aims to estimate the value of plain packaging with large HWLs and dissuasive sticks on cigarettes to Colombian adults. With this study we aim to address three questions: (i) What is the value of plain packaging with large HWLs to both smokers and nonsmokers, and to what extent are valuation differences associated with harmfulness perceptions?; (ii) What is the value of dissuasive sticks to both smokers and nonsmokers, and to what extent are valuation differences associated with harmfulness perceptions?; and (iii) How do valuations of plain packaging and dissuasive sticks change by the availability of the illicit alternative?

We implemented a stated preferences discrete choice experiment (Becker et al., 1964; Rousu et al., 2014–12) in two contexts: one in which only licit options are presented to participants and a second one in which an illicit tobacco product is available. Through the two designs, we could estimate the value that smokers receive from pictorial labels and provide more robust conclusions on the WTP to avoid HWLs in Colombia. The inclusion of both smokers and nonsmokers will allow us to better inform the Ministry of Health on the potential impact of additional tobacco control measures on the general population. The experimental design, data collection, and analysis followed the Professional Society for Health Economics and Outcomes Research (ISPOR) checklist on good research practices for conjoint analysis (Bridges et al., 2011/06). Notwithstanding the similarities with Sillero-Rejon et al. (2022), in terms of analysing HWL for smokers and nonsmokers, our study extends the setting to the existence of illicit trade and cigarettes' warnings.

The remainder of the paper is set out as follows. In Section 2, we

describe the experimental design and the data collection, and we set out the model and its features. In Section 3, we present the sample characteristics and the results from the models. In Section 4, we include some discussion around the most relevant findings and the conclusions that emerged from this study.

2. Methods

2.1. Attributes, levels, and choice task

Discrete choice experiments (DCE) have been widely used in the tobacco literature to elicit causal effects of attributes on tobacco product choices (Louviere et al., 2000; Regmi et al., 2018). In these experiments, respondents are presented with a set of choice scenarios, with different cigarette/packaging attribute combinations. In each scenario, respondents are asked to choose their preferred option according to the attributes or characteristics of the tobacco alternatives. Our design, involving products from illicit markets and dissuasive sticks, is based on that of Guindon, Mentzakis, and Buckley (Guindon et al., 2024). The original design Research Ethics Board approval was obtained for Ontario, Canada (Hamilton Integrated Research Ethics Board (HiREB); HiREB Project #: 2652). Universidad del Rosario Ethics on Research board adhered to such approval, for the fieldwork in Colombia (DVO005 833 – CS499).

In our experiment, packages are described by three attributes common in the literature (Moodie et al., 2012; Regmi et al., 2018), as presented in Table 1. The package and cigarette stick attributes were described using two levels: one that corresponds to the current regulation in the country (standard package with HWLs covering 30% of pack's surface and branded cigarette stick) and a hypothetical one with plain packaging and a large pictorial HWL covering 100% of pack's surface, and dissuasive cigarette sticks. The package and cigarette stick characteristics of the illicit option did not vary. The price attribute of a package of 20 cigarettes varies across six and two levels for legal and illegal products, respectively. Price levels were based on the retail prices of different brands and types of 20-cigarette packs available in the Colombian market (DANE and DANd, 2020). To set the prices of the illicit tobacco package, we used the Demand for Illicit Cigarettes Survey Colombia 2016 (DEICS-CO), which was collected by a Colombian non-governmental organization (Fundación Anáas), with the financial support of the American Cancer Society and Cancer Research UK (Maldonado et al., 2020; Gallego et al., 2020/12).

An online survey was designed to conduct the experiment. In each scenario, respondents were presented with three tobacco options and an opt-out option. A choice scenario example is presented in Fig. 1. We chose one of the most popular brands in the market (Lucky Strike) as there is a brand from the illicit market (Gold Seal) which has similar colours and general design, reducing the potential impact of differences of the branded design on choices.

Table 1
Attributes and levels.

	Licit tobacco package (Lucky Strike)	Illicit tobacco package (a)
Package	Standard package Plain package and a large pictorial HWL	Standard package
Cigarette stick	Branded With warning (dissuasive)	Branded
Price in USD (b)	$ 3.14 $ 2.61 $ 2.37 $ 2.16 $ 1.97 $ 1.79	$ 1.84 $ 0.79

Note: (a) Following Ross (2015), an illicit tobacco package is defined as a package of cigarettes produced abroad that does not fulfill all obligations from customs and health authorities. (b) All prices were presented in Colombian pesos (COP) during the experiment. We use an exchange rate of COP $3.800.

2.2. Experimental design

We generated one experimental design with only licit tobacco package alternatives (Design A) and a second design that includes the illicit alternative (Design B). With both designs, respondents had to choose between four alternatives. We used a D-efficient factorial design to generate the experimental scenarios in the software Ngene (Bliemer et al., 2015) (www.choice-metrics.com), with priors based on a pilot with 459 participants. For Design A, the most efficient design resulted in six choice sets (D-error = 0.34), which were all presented to participants (Block 1, here onwards). For Design B, the most efficient design involved 12 choice sets (D-error = 0.22), which were blocked into two groups (Blocks 2 and 3, here onwards), aimed at minimizing potential cognitive burden and respondent fatigue (Hess et al., 2012). Both designs included restrictions to avoid dominant alternatives and/or unrealistic choice sets.

Participants were randomly assigned to respond to one of three blocks, each with the corresponding six choice sets and a dominant test (seven choice tasks in total). The dominant test (the fifth choice set) was added to determine the proportion of individuals who choose a dominated option (Inza et al., 2008). In the dominant test for Design A, the most expensive option is the plain package with the warning on the stick, the mid-price option is the plain package without such a warning, and the cheapest is the branded package. For Design B, the dominant alternative corresponds to the branded package, cheaper than the plain one, and the illicit option is at its highest price (but still cheaper than the licit options).

2.3. Survey, sample, and data collection

An online survey was designed to conduct the experiment. Appendix 11 presents the questionnaire.

At the start of the survey, we introduced the products available for the experiment and described their characteristics to the participants. For the case of the illicit product, we indicated to them explicitly that it comes from illicit trade, the authorities have not verified its components, and taxes were not paid for this product. In addition, while not explicitly mentioned in the experiment, it is common knowledge that in Colombia people cannot be arrested or fined for the possession of small quantities or consumption of illicit drugs such as cannabis or illicit tobacco products.

The survey consisted of four sections. Section 1 included general information about the study, the informed consent, and screening questions to either qualify or disqualify respondents. Section 2 explained the choice task and presented two examples, two practice questions, and seven choice tasks that respondents were asked to complete. In each choice task, respondents were asked to choose among cigarette packs with different branding, HWLs, and prices. Section 4 consisted of a set of socio-demographic questions, including smoking-habit questions.

The survey was piloted twice, with a sample size of 10 and 459, respectively. Wording changes were introduced after the first pilot. The dominant test and minor adjustments on prices were introduced after the second pilot.

The survey was conducted in December 2021 via an online panel from Netquest, a company that specializes in online survey services. In this study, we aimed to collect responses from male and female Colombians: 400 responses from smokers between 18 and 25 years old (*young smokers*, here onwards), 800 responses from smokers between 26 and 65 years old (*adult smokers*), and 500 responses from nonsmokers between 18 and 25 years old (*young nonsmokers*). Both sample sizes were larger than the minimum required (Louviere et al., 2000; Reed Johnson et al., 2013/01). However, we did not perform a sample size calculation based on expected effect sizes as there was no published study similar to

Package 1	Package 2	Package 3
		
$6.800 (USD $1.79)	$11.950 (USD $3.14)	$7.000 (USD $1.84)

Smokers: If the three presented packs were the only options available, would you buy one of the three or choose not to smoke? / **Nonsmokers:** If the three presented packs were the only options available, which one would most encourage someone like you to smoke?

- Package 1
- Package 2
- Package 3
- **Smokers**: None of the above* / **Nonsmokers**: I wouldn't know - Other Which one?

Which of these options do you think would pose the least risk to your health?

- Package 1
- Package 2
- Package 3
- I wouldn't know - Other Which one?

* For the first question about intention to purchase, respondents were instructed as follows: "choosing 'none' implies that you would choose not to smoke

Fig. 1. Example of a choice task.

ours at the moment of the design of this study. As part of our analysis, we performed an ex-post check based on our results following Bekker-Grob et al. (de Bekker-Grob et al., 2015).

2.4. Analysis

All data analyses for the DCE were performed in Stata (v.17SE)(Stata Statistical Software, 2018). We used a conditional logistic regression (clogit) to model choice data (Louviere et al., 2000; Ryan et al., 2008). Our clogit, a generalised linear model, considers the following linear component for explaining the specific choice probability:

$$U_j = \beta_1 \cdot Price_j + \beta_2 PlainPack_j + \beta_3 Dissuasive_j + \beta_4 None_j + \beta_5 Illicit \quad (1)$$

where U_j corresponds to choosing alternative j, $PlainPack_j$ is 1 for the alternative that considers an alternative with plain package and large HWL instead of the branded pack, $Dissuasive_j$ is 1 if it includes a dissuasive stick, $None_j$ is 1 for the opt-out alternative. For Design 2, *Illicit* is 1 for the illicit pack, 0 for any version the licit option. With these coefficients we compute WTP by dividing coefficients β_2, β_3 and β_5 on β_1. We also compute marginal effects with the predicted choice probabilities: we establish a base scenario, compute the probability, and then compute it again but changing the characteristic of interest. The percentual variation (in percentage points, "pp") is the estimate of the marginal effect ("ME"). For these computations, our base price is $2.

To account for heterogeneity and to identify subgroups of respondents with similar preference patterns (Greene and Hensher, 2003/09; Hess, 2014a), we conducted a latent class analysis and estimated models with two to seven classes (Hess, 2014b). These are semi-parametric models, and as such freed the analysis from unwarranted distributional assumptions. The class membership is modelled to depend on age, sex, education (high school, technical, college dummies), and income level. The choice of the optimal number of classes remains an issue, as it is a trade-off between explanatory power, the number of additional parameters, and ease of interpretation (Czajkowski et al., 2020/06). We used the routine *lclogitlm2* (Yoo, 2020) to estimate the model coefficients and to derive the corresponding WTPs. Finally, we assigned membership to a class based on the highest predicted probability of belonging to each of them.

3. Results

3.1. Sample characteristics

The final sample size was 1761 individuals, of which 423 were young smokers, 823 adult smokers, and 515 young nonsmokers. In order to achieve a power of 80% at an α level of 0.05 for two-sided tests to detect the coefficients of dissuasive sticks (the smallest coefficients) found in the main analysis (see below), sample size calculations for Design B, which has more alternatives, suggested at least 830 smokers and 453 nonsmokers were required. Therefore, our experiment sample size was large enough to detect effects as large as our observed coefficients.

Self-reported characteristics included age, sex, education level, and income. In addition, respondents reported their smoking status, whether they utilized e-cigarettes, and the number of cigarettes consumed per day. Table 2 displays these characteristics for the three different groups of respondents: adult smokers, young smokers, and young nonsmokers. Descriptive statistics per block are presented in Supplemental material (Appendix 1). Current smokers are those who reported they smoked daily or occasionally. Among the two groups of smokers, there are several differences to highlight: (i) relative to young smokers, adult

Table 2
Sample characteristics.

Respondent type	Adult Smokers		Young Nonsmokers		Young Smokers	
	Mean or %	SD	Mean or %	SD	Mean or %	SD
Demographics						
Age	41.23	10.68	22.17	2.19	22.72	1.94
Male (%)	0.62	0.49	0.41	0.49	0.51	0.5
Education level						
High school (%)	0.07	0.26	0.28	0.45	0.24	0.43
Technical degree (%)	0.27	0.44	0.35	0.48	0.34	0.47
Undergrad or higher (%)	0.62	0.49	0.32	0.47	0.34	0.47
Income level						
Low (%)	0.17	0.37	0.33	0.47	0.26	0.44
High (%)	0.79	0.4	0.61	0.49	0.67	0.47
Smoking periodicity						
Never (%)	0	0	0.8	0.4	0	0
Used to (%)	0	0	0.2	0.4	0	0
Occasionally (%)	0.48	0.5	0	0	0.76	0.43
Daily (%)	0.52	0.5	0	0	0.24	0.43
Age of first cigarette	18.12	6.93	N/A	N/A	16.57	4.29
Tried to stop last year (%)	0.68	0.47	0	0	0.72	0.45
Tobacco product consumption						
Cigarettes per day	4.29	5.82	0	0	1.89	2.58
Tried e-cigarettes (%)	0.23	0.42	0.04	0.19	0.29	0.46
Observations	819		514		419	

smokers were more likely to be males, were more educated, had higher income levels, were less likely to have tried quitting smoking, and smoked more often and in higher quantities (number of sticks per day); (ii) among the young, smokers were more likely to be males than non-smokers, but were as educated and had a slightly higher income level (see Appendix 2 in Supplemental material). These differences were similar to those observed in the literature (Hammond, 2005; DAN E. and Encuesta Nacional de Consumo de Sustancias Psicoactivas (ENCSPA), 2020). Respondents' characteristics were balanced across the three sampling blocks, as expected (see Appendix 3 in Supplemental material).

We assessed the reliability of responses in three ways. First, of the 12,327 choices represented in the dataset, 2302 involved a dominated option. Of these potential choices, nearly 20% resulted in the choice of the dominated option. In terms of individuals, 20.7% (N = 365) of the respondents chose at least one dominated option in the study. Second, the mean response time was 19.4 min (median of 15 min); Fewer than 1% (N = 20) answered the entire survey in less than 5 min while 2.2% took more than 1 h (N = 39). The DCE took on average 5.7 min (SD = 7.1; Min = 0.6; Max = 127.6). Third, 96.4% of the respondents completed the entire exercise (N = 1698). Most dropouts were at the end of the DCE (N = 16) and at the final survey section where information about income and smoking habits was requested (N = 29). In light of these results, we consider responses reliable.

Respondents tended to make a choice in most of the presented scenarios, smokers opted out in around 7% of the cases and nonsmokers around 9%. Not surprisingly, in the absence of the illicit option both smokers and nonsmokers tended to choose the branded packages (See Table 3, columns 1 & 2). However, the introduction of the illicit product shifts the choice shares towards this option, especially for nonsmokers.

3.2. Logistic regression models

The average marginal effects (Panel A) and estimated WTP (Panel B) of each attribute on the choice are presented in Table 4. Table 5 presents the marginal effects for choosing the product that possesses the least health risk. Predicted probabilities are reported in Appendix 4 in Supplemental material.

Table 3
Choice frequencies.

	Design A (Only licit alternatives)		Design B (Licit & illicit alternatives)	
	(1)	(2)	(3)	(4)
	Nonsmokers	Smokers	Nonsmokers	Smokers
Opt-out	0.082	0.060	0.109	0.071
Illicit			0.448	0.202
Plain with warning sticks	0.064	0.174	0.036	0.117
Plain with not-branded sticks	0.065	0.062	0.036	0.077
Standard with warning sticks	0.362	0.377	0.160	0.241
Standard with branded sticks	0.427	0.327	0.210	0.291
Respondents	147	426	367	812

Table 4
Conditional logit models, intention to purchase.

Panel A. Marginal effects	Design A (Only licit alternatives)		Design B (Licit & illicit alternatives)	
	(1)	(2)	(3)	(4)
	Nonsmokers	Smokers	Nonsmokers	Smokers
Price	−0.080***	−0.182***	−0.015***	−0.099***
	(0.030)	(0.010)	(0.0064)	(0.007)
Plain package with 100% HWL	−0.314***	−0.250***	−0.090***	−0.205***
	(0.087)	(0.013)	(0.007)	(0.007)
Dissuasive stick	−0.087**	0.092***	−0.012*	0.028*
	(0.053)	(0.021)	(0.006)	(0.012)
Illicit			0.508***	−0.047*
			(0.035)	(0.021)
Respondents	147	426	367	812
Log-likelihood	−990	−3100	−2868	−6236
AIC	1988	6207	5748	12,483
BIC	2013	6237	5,7840	12,523
Panel B. Willingness to pay (USD)				
	Design A		Design B	
	Nonsmokers	Smokers	Nonsmokers	Smokers
Plain package	−8.397***	−1.810***	−12.664***	−3.168***
	(3.180)	(0.161)	(3.602)	(0.282)
Dissuasive stick	−1.105**	0.299***	−0.801	0.217*
	(0.630)	(0.065)	(0.518)	(0.090)
Illicit option			11.237***	−0.416*
			(3.370)	(0.185)

Note: Standard errors in parentheses. Significance: ***p < 0.01, **p < 0.05, *p < 0.1. Marginal effects for variable "None" are omitted from the output. For calculating the marginal effect of price on the individual's probability of choosing a cigarette package, we used the USD $2 branded package without the dissuasive stick as the reference.
AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion.

3.2.1. The value of plain packaging and a large pictorial HWL without illicit options (design A)

The price of legal packages has the expected negative sign and is statistically significant for both smokers and nonsmokers (Table 4, Panel A, Columns 1 and 2). On average, smokers prefer branded packages (not plain packages) and would be willing to pay USD $1.81 (WTP = −1.810, 95% CI = [−2.126, −1.494], P < 0.01) to avoid plain packages when only legal options are available. Given that the midpoint price for a licit pack of cigarettes is $2.37, this is a price increase of 76%. Results are roughly similar between young (WTP = −1.923, 95% CI = [−2.423, −1.423], P < 0.01) and adult smokers (WTP = −1.707, 95% CI = [−2.095, −1.319], P < 0.01 - See Appendix 6 in Supplemental material).

Table 5
Conditional logit models, risk perceptions (least risk to health), marginal effects.

	Design A (Only licit alternatives)		Design B (Licit & illicit alternatives)	
	(1)	(2)	(3)	(4)
	Nonsmokers	Smokers	Nonsmokers	Smokers
Price	0.029	−0.014	−0.002	−0.019***
	(0.023)	(0.008)	(0.006)	(0.005)
Plain package with 100% HWL	−0.159***	−0.103***	−0.079***	−0.099***
	(0.026)	(0.013)	(0.010)	(0.007)
Dissuasive stick	−0.051*	0.009	0.010	0.010
	(0.023)	(0.012)	(0.010)	(0.008)
Illicit			0.117***	−0.043**
			(0.033)	(0.016)
Respondents	139	426	367	812
Log-likelihood	−1338	−4017	−3452	−7583
AIC	2683	8041	6915	15,175
BIC	2708	8071	6951	15,216

Note: Standard errors in parentheses. Significance: ***p < 0.01, **p < 0.05, *p < 0.1. Marginal effects for variable "None" are omitted from the output. AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion.

Among nonsmokers, plain packages would discourage them to start smoking more than branded ones, and they reported a WTP of USD $8.397 to avoid the plain package (WTP = −8.397, 95% CI = [−14.630, −2.164], P < 0.01 – Table 4 Panel B, Column 1).

In regards to risk perceptions, both nonsmokers and smokers consider the branded package a safer option than the plain package (ME = −15.9 pp, 95% CI = [−21.0, −10.8], P < 0.01 and ME = −10.3 pp, 95% CI = [−12.8, −7.8], P < 0.01, respectively, in Table 5, Columns 1 and 2).

3.2.2. The value of dissuasive sticks without illicit options (design A)

When it comes to warning or dissuasive sticks, smokers seem to be more likely to choose dissuasive sticks than sticks without the health warning (extra 9.2 pp, 95% CI = [5.1, 13.3], P < 0.01). The WTP for the warning on the sticks is USD $0.29 (WTP = 0.299, 95% CI = [0.172, 0.426], P < 0.01). This result is mainly driven by adult smokers, who reported being more willing to choose and pay for a cigarette with the warning label (WTP = 0.390, 95% CI = [0.233, 0.547], P < 0.01 - see Appendix 6 in Supplemental material). Moreover, dissuasive sticks do not seem to have a significant impact on the perceived health risks for smokers (0.9pp, 95% CI = [−1.5, 3.3]).

On the contrary, and as expected, nonsmokers indicate that dissuasive sticks, compared to unlabeled ones, would discourage them from starting to smoke (−8.7 pp, 95% CI = [−15.3, −2.0], P < 0.1), with an associated WTP of USD $1.105 less (but not significant: WTP = −1.105, 95% CI = [−2.340, 0.129], P > 0.1). In line with this result, nonsmokers perceive dissuasive sticks as riskier than unlabeled ones (extra 5.1pp, 95% CI = [−9.6, −0.6], P < 0.05).

3.2.3. Valuations when an illicit alternative is available (design B)

The presence of an illicit alternative seems to change valuations, particularly among nonsmokers. Columns 3 and 4 of both Tables 3 and 4 present the results for Design B. Plain packages are less likely to be chosen by smokers (ME = −20.5pp, 95% CI = [−21.9, −19.1], P < 0.01) and nonsmokers (ME = −9.0 pp, 95% CI = [−10.3, −7.6], P < 0.01), as before. But the main difference is that the WTP for avoiding plain packages increases from USD $1.80 to $3.16 for smokers (WTP = −3.168, 95% CI = [−3.721, −2.615], P < 0.01), and from USD $5.63 to $12.14 for nonsmokers (WTP = −12.142, 95% CI = [−18.886, −5.398], P < 0.01). In terms of risk perception, plain packaging maintains a significant effect (Nonsmokers, ME = −7.9pp, 95% CI = [−9.9, −5.9], P < 0.05; Smokers, ME = 9.9pp, 95% CI = [0.07, 11.3], P < 0.01).

In regards to dissuasive sticks, marginal effects remain statistically significant for smokers (ME = 2.8pp, 95% CI = [0.4, 5.2], P < 0.1) but not for nonsmokers (ME = −1.2pp, 95% CI = [−2.4, −0.0002]), and WTP valuations are similar (Nonsmokers, WTP = −0.801, 95% CI = [−1.816, 0.214] Smokers, WTP = 0.217, 95% CI = [0.041, 0.393], P < 0.1). In terms of risk perception, the dissuasive stick is no longer statistically significant for nonsmokers (ME = 0.01, 95% CI = [−0.010, 0.030]).

For the specific choice of the illicit option, smokers are 4.7 pp less likely to buy products from illicit trade (ME = −0.047, 95% CI = [−0.088, −0.006], P < 0.1) and are willing to pay USD $0.41 to avoid them (WTP = −0.416, 95% CI = [−0.779, −0.053], P < 0.1), suggesting that smokers do value purchasing recognized legal tobacco products (Table 4, Column 4). This is in line with the higher perception of health risk posed by the illicit package compared to the plain package (ME = −0.043, 95% CI = [−0.074, −0.012], P < 0.05 - see Table 5, Column4).

If we consider results by age, we find that the WTP is larger for young smokers than for adult smokers: USD $0.61 vs. $0.28, respectively (Young, WTP = −0.611, 95% CI = [−1.126, −0.096], P < 0.1; Adult, WTP = −0.285, 95% CI = [−0.781, 0.211] - see Appendix 6 in Supplemental material). The difference is substantial according to smoking intensity, as heavy smokers do not place a negative WTP on the illicit option (WTP = 0.151, 95% CI = [−0.743, 1.045]). In contrast, we do not observe substantial differences according to income.

Among nonsmokers, the results are substantially different. They consider illicit cigarettes more likely to encourage people like them to smoke (ME = 50.8 pp, 95% CI = [43.9, 57.6], P < 0.01), which is compatible with the positive risk perception that they have about illicit cigarettes (ME = 0.117, 95% CI = [0.052, 0.182], P < 0.01).

3.3. Latent class models

We expanded the analysis to detect potential unobserved heterogeneity in terms of the valuation of the packaging alternatives.

To uncover group-wise behavior, a latent class model with two classes was used for each of the two experimental designs. The WTP results are reported in Appendix 8A, and the coefficients and mean characteristics of individuals classified in each latent class according to their highest-class membership predicted probability in Appendix 8B. While goodness-of-fit criteria suggested to use more classes (Appendix 7) (Ryan et al., 2008; Lancsar et al., 2017/07), there were no substantial differences in terms of the characteristics associated with each additional class. Hence, we prioritized ease of explanation to present the main results.

For smokers and nonsmokers in both designs, Class 1 (share of 91.9% in Design A and 51.7% in Design B) consisted of more females who were less educated than Class 2. For smokers, in terms of smoking intensity, smokers in Class 1 consumed fewer cigarettes per day, started smoking later in life, and were more likely to have tried to stop smoking the previous year. While standard errors are large, limiting our ability to draw conclusions, Class 1 had a higher WTP than Class 2 for avoiding plain packaging (Design A, WTP = 4.20, 95% CI = [−21.94, 13.54]; Design B = 2.65 95% CI = [−7.88, 2.48]), and they are also the ones with a negative valuation of illicit cigarettes.

Appendix 9 shows the latent class analysis for risk perceptions. Class 1, still the one with lower smoking frequencies, perceives illicit cigarettes to be riskier than the standard branded ones. The opposite occurs for Class 2 smokers, who consider the illicit choice less risky. These Class 2 smokers also consider the presence of a dissuasive stick to indicate a less risky alternative. For nonsmokers, the class with fewer former smokers is the one that considers the illicit choice as less risky. This reinforces the hypothesis that the presence of illicit alternatives is riskier for those individuals who do not know the market.

4. Robustness check

First, we excluded from the sample people who made choices that we considered dominated alternatives (20.7% of the respondents): for a

similar or cheaper price, they chose illicit cigarettes over the plain or branded package, or the plain over the branded package. Such choices are not necessarily a "mistake" or proof of choosing options randomly; they could also express specific behavioral strategies. For instance, one of the respondents commented that they "prefer" the plain package as a strategy to quit smoking faster. Panel A of Appendix 10 shows that the WTP derived from the DCE exercise presents almost no difference with respect to the main exercise.

Second, we considered only respondents who took more than 5 min and less than 60 min to complete the choice experiment (excluded respondents = 59). These are respondents who were most likely to have taken the time to read the instructions and to have responded conscientiously to each of the choice tasks. Panel B of Appendix 10 shows that the WTP is similar for smokers (Columns 2 and 4) but is slightly smaller for nonsmokers. In particular, the branded package valuation for Design 1 is closer to the valuation of nonsmokers in Design 2.

5. Discussion and conclusions

This study estimates the WTP and risk perceptions that Colombian (young) nonsmokers and smokers have for plain packaging with 100% HWL and dissuasive sticks, under the presence or not of illicit market alternatives. The results contribute not only to the literature by adding features to respondents' choice sets, but also aim to inform tobacco control policies in low- and middle-income countries. A better understanding of people's views about tobacco packaging, brand appeal, salience of HWLs, and availability of illicit cigarettes could help policymakers design effective tobacco control policies.

In terms of the central findings, first, consistent with economic theory and the literature, both smokers and nonsmokers prefer lower prices (Chaloupka et al., 2000; Zheng et al., 2017), although smokers are more price-sensitive.

Second, plain packaging with 100% HWL seems to discourage smoking, particularly among nonsmokers, for whom the marginal effect is twice the size than for smokers. The result is a WTP to avoid the plain package with 100% HWL substantially higher than the actual commercial price of the package (USD $5.60 vs. $2.40). These results confirm the role of plain packaging in preventing smoking initiation and are fairly aligned with the visual attention and pack preferences results for this study. Though not directly comparable due to reporting differences, our study also finds that plain packaging leads to lower odds of trying the cigarettes (Sillero-Rejon et al., 2022). Nevertheless, we do not find the same heterogeneity across age groups: regardless of how old the respondent was, the nonbranded feature had a fairly stable and negative effect on preferences.

Third, the presence of illicit alternatives generates important differences in the valuations. First, plain packaging with 100% HWL becomes more salient, and the marginal effect is smaller for both smokers and nonsmokers. Second, smokers are less likely to choose the illicit product than the branded packaging, but nonsmokers are more likely to choose the illicit one. This result could be explained by the lack of knowledge about tobacco products in the market, as the majority have not smoked in the past (20%). In such a scenario, the result is expected due to the attractiveness of illicit packages relative to the legal branded or plain ones.

Fourth, we considered dissuasive sticks as a potential strategy to overcome the reduced exposure to the package strategies in the context of single-cigarette sales. Unlike plain packaging, smokers and nonsmokers seem to respond differently to dissuasive sticks. While dissuasive sticks would discourage nonsmokers from smoking, smokers reported a positive valuation for dissuasive sticks. This result for smokers is unexpected but is consistent across the three blocks of the experiment, regardless of the presence of illicit alternatives. Current literature has studied the appeal of dissuasive sticks and the odds of choosing an alternative that includes them. Both of them are lower than those of standard sticks[23] [24]. Yet, stick presentation has not been considered jointly with the corresponding package, nor with prices, nor in middle-income countries. As such, a potential explanation is that in the presence of illicit alternatives in the market, smokers might consider a standardized stick to allow for an easy differentiation of original products from counterfeits and unknown products coming from illicit markets. Further research on the topic of dissuasive sticks is required.

Some limitations should be considered in terms of the extent of the interpretation of our results. First, as we used a convenience sampling strategy via an internet panel, the external validity might be compromised for groups that are less likely to be part of internet panels (respondents living in rural areas or less educated, for example). Also, results are likely to hold in similar cultural and institutional backgrounds (i.e., Latin America and the Caribbean), but might not be directly extrapolated elsewhere. Second, the study does not consider the role of e-cigarettes as potential substitutes in the market, especially for young individuals. Future studies could include e-cigarettes as alternatives and assess valuations and preferences among smokers and nonsmokers in the presence of illegal cigarettes. In addition, our study has a particular selection of brands. We are unable to assess if results would change substantially with smaller HWL in the plain package, or with other brands from illicit markets that have HWL like those of the branded package.

Another limitation stems from the intrinsic characteristics of choice experiments, particularly the challenge of ensuring that results truly capture participants' preferences. The theoretical scenarios employed in DCEs often complicate the assessment of stated preferences' validity. Yet, the push for validating choice experiments in healthcare, as recommended by best practice guidelines, is noteworthy (Rakotonarivo et al., 2016/12). External validity, evaluated through the alignment of estimated preferences with real-world decisions (revealed preferences), shows that DCEs can yield reliable insights, especially regarding familiar decisions, which is the case for smokers' choices in this study (Rakotonarivo et al., 2016/12; Janssen et al., 2017). However, the extrapolation of findings from young nonsmokers about unfamiliar products may not accurately reflect their actual decisions. While this is a limitation, it is also important to consider good research practice in stated preference studies, as data quality is not guaranteed by focusing only on reliability and validity testing. Aspects such as respondent understanding or a diverse sample are crucial to ensure the quality of the data collected.

Our results confirm the effectiveness and relevance of plain packaging as a tobacco control policy in the context of informal markets. We also show that dissuasive sticks, at least in the form presented in our study, do not change risk perceptions, and are even valued positively by smokers. We hypothesize that it becomes a device to disentangle counterfeit products, although future research could explore this behavior in depth and shed light on potential adjustments to this tobacco control strategy. Our results also show that illicit cigarettes pose a risk for nonsmokers, as perceptions of higher risk and less appeal of illicit products, which are clear for smokers, are not present for nonsmokers. From a tobacco control policy perspective, these results reinforce the need to eliminate all forms of illicit trade in tobacco products.

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Declarations of interest

None reported.

Ethics approval

The original design Research Ethics Board approval was obtained for Ontario, Canada (Hamilton Integrated Research Ethics Board (HiREB); HiREB Project #: 2652). Universidad del Rosario Ethics on Research board adheres to such approval, for the fieldwork in Colombia (DVO005 833 – CS499). We confirm that all methods were carried out in accordance with relevant guidelines and regulations that is Declaration of Helsinki.

Patients' consent

Informed consent was obtained from all participants, following the rules and protocols of Netquest, the firm that manages the panel.

CRediT authorship contribution statement

Paul Rodríguez-Lesmes: Conceptualization, Investigation, Software, Formal analysis, Writing – original draft, Writing – review & editing. **Pamela Góngora-Salazar:** Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Emmanouil Mentzakis:** Conceptualization, Methodology, Software, Writing – original draft, Validation **Neil Buckley:** Conceptualization, Methodology, Validation. **Juan Miguel Gallego:** Conceptualization, Project administration, Validation. **G. Emmanuel Guindon:** Conceptualization, Project administration, Funding acquisition, Validation. **Juan Pablo Martínez:** Data curation, Formal analysis, Software, Visualization, Writing – original draft. **Guillermo Paraje:** Conceptualization, Project administration, Funding acquisition, Validation.

Data availability

Replication materials are available at: https://github.com/androdri1/DCEillicitColombia.

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Appendix A. Supplementary data

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References

Alcaraz, A., Hernández-Vásquez, A., Palacios, A., et al., 2020. Health and economic impact of health warnings and plain tobacco packaging in seven Latin American countries: results of a simulation model. Nicotine Tob. Res. 22 (11), 2032–2040. https://doi.org/10.1093/ntr/ntaa104.

Arora, M., Tewari, A., Nazar, G., et al., 2013. Exploring perception of Indians about Plain Packaging of tobacco products: a mixed method research. Original research. Front. Public Health 1doi. https://doi.org/10.3389/fpubh.2013.00035.

Barrientos-Gutierrez, I., Islam, F., Cho, Y.J., et al., 2020. Assessing cigarette packaging and labelling policy effects on early adolescents: results from a discrete choice experiment. Tobac. Control 30 (5), 505–514. https://doi.org/10.1136/tobaccocontrol-2019-055463. ISSN 0964-4563 1468-3318.

Becker, G.M., Degroot, M.H., Marschak, J., 1964. Behavioral Science. 1964/01/01. Measuring Utility by a Single-Response Sequential Method, vol. 9, pp. 226–232. https://doi.org/10.1002/bs.3830090304, 3.

Bliemer, M., Collins, A., 2015. Experimental design and choice experiments. In: D, H, W., G, M.R.J. (Eds.), Applied Choice Analysis. Cambridge University Press, pp. 189–319.

Bogliacino, F., Codagnone, C., Veltri, G.A., et al., 2015. Pathos & ethos: emotions and willingness to pay for tobacco products. PLoS One 10 (10), e0139542. https://doi.org/10.1371/journal.pone.0139542.

Bridges, J.F.P., Hauber, A.B., Marshall, D., et al., 2011. Conjoint analysis applications in health—a checklist: a report of the ISPOR good research practices for conjoint analysis task force. Value in Health 14 (4), 403–413. https://doi.org/10.1016/j.jval.2010.11.013.

Chaloupka, F., Warner, K.E., 2000. The economics of smoking. In: Culyer, A.J., Newhouse, J.P. (Eds.), Handbook of Health Economics. Elsevier, pp. 1539–1627 chap. 29.

Chang, K., Mayne, E., Laverty, A.A., Agaku, I., Filippidis, F.T., 2021. Cigarette prices in eight sub-Saharan African countries in 2018: a cross-sectional analysis. BMJ Open 11 (10), e053114. https://doi.org/10.1136/bmjopen-2021-053114.

Czajkowski, M., Gajderowicz, T., Giergiczny, M., Grotkowska, G., Sztandar-Sztanderska, U., 2020. Choosing the future: economic preferences for higher education using discrete choice experiment method. Res. High. Educ. 61 (4), 510–539. https://doi.org/10.1007/s11162-019-09572-w.

DANE. Encuesta Nacional de Consumo de Sustancias Psicoactivas (ENCSPA), 2020. Periodo de referencia 2019. Boletín Técnico. https://www.dane.gov.co/files/investigaciones/boletines/encspa/bt-encspa-2019.pdf.

DANE, 2020. Certificación para cigarrillos - II semestre de 2020. In: DANd, Estadistica (Ed.), Resolucion No 0735 de 2020. D.C, Bogota.

de Bekker-Grob, E.W., Donkers, B., Jonker, M.F., Stolk, E.A., 2015. Sample size requirements for discrete-choice experiments in healthcare: a practical guide. Patient 8 (5), 373–384. https://doi.org/10.1007/s40271-015-0118-z.

Drovandi, A., Teague, P.-A., Glass, B., Malau-Aduli, B., 2019. A systematic review of the perceptions of adolescents on graphic health warnings and plain packaging of cigarettes. Syst. Rev. 8 (1), 25. https://doi.org/10.1186/s13643-018-0933-0.

Evans, A., Peters, E., Strasser, A., Emery, L., Sheerin, K., Romer, D., 2015. Graphic Warning Labels Elicit Affective and Thoughtful Responses from Smokers: Results of a Randomized Clinical Trial, p. 1.

FCTC. Plain packaging meetings in Geneva to discuss legal challenges, 2017. Updated 5 October policy design and implementation. https://fctc.who.int/newsroom/news/item/05-10-2017-plain-packaging-meetings-in-geneva-to-discuss-legal-challenges-policy-design-and-implementation. (Accessed 2 June 2022).

Ford, A., Moodie, C., Hastings, G., 2012. The role of packaging for consumer products: understanding the move towards 'plain' tobacco packaging. Addiction Res. Theor. 20 (4), 339–347. https://doi.org/10.3109/16066359.2011.632700.

Freeman, B., Watts, C., Astuti, P.A.S., 2022. Global tobacco advertising, promotion and sponsorship regulation: what's old, what's new and where to next? Tobac. Control 31 (2), 216. https://doi.org/10.1136/tobaccocontrol-2021-056551.

Gallego, J.M., Llorente, B., Maldonado, N., Otálvaro-Ramírez, S., Rodríguez-Lesmes, P., 2020. Tobacco taxes and illicit cigarette trade in Colombia. Econ. Hum. Biol. 39, 100902 https://doi.org/10.1016/j.ehb.2020.100902.

Gantiva, C., Sotaquirá, M., Camacho, K., Hernández-Mateus, V., Restrepo-García, A., Castillo, K., 2021. Emotional impact of graphic health warnings on tobacco packages in Colombia. Canadian Journal of Behavioural Science Revue canadienne des sciences du comportement 53 (3), 296–303. https://doi.org/10.1037/cbs0000249.

Germain, D., McCarthy, M., Wakefield, M., 2010. study. Addiction. 2010/01/01. In: Smoker Sensitivity to Retail Tobacco Displays and Quitting: a Cohort, 105, pp. 159–163. https://doi.org/10.1111/j.1360-0443.2009.02714.x, 1.

Greene, W.H., Hensher, D.A., 2003. A latent class model for discrete choice analysis: contrasts with mixed logit. Transp. Res. Part B Methodol. 37 (8), 681–698. https://doi.org/10.1016/S0191-2615(02)00046-2.

Guindon, G.E., Mentzakis, E., Buckley, N.J., 2024. Cigarette packaging, warnings, prices, and contraband: a discrete choice experiment among smokers in Ontario, Canada. Econ. Hum. Biol. 52, 101340 https://doi.org/10.1016/j.ehb.2023.101340.

Guzman-Tordecilla, D.N., Llorente, B., Vecino-Ortiz, A.I., 2022. Evaluation of the implementation of the Framework convention on tobacco control (FCTC) in Colombia. Health Pol. Plann. 37 (3), 349–358. https://doi.org/10.1093/heapol/czab143.

Haighton, C., Taylor, C., Rutter, A., 2017. Standardized packaging and illicit tobacco use: a systematic review. Tob Prev Cessat 3. https://doi.org/10.18332/tpc/70277, 13-13.

Hammond, D., 2005. Smoking behaviour among young adults: beyond youth prevention. Tobac. Control 14 (3), 181–185. https://doi.org/10.1136/tc.2004.009621.

Hammond, D., Fong, G.T., McNeill, A., Borland, R., Cummings, K.M., 2006. Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey. Tobac. Control 15 (Suppl. 3), iii19.

Hammond, D., Dockrell, M., Arnott, D., Lee, A., McNeill, A., 2009. Cigarette pack design and perceptions of risk among UK adults and youth. http://explore.bl.uk/primo_library/libweb/action/display.do?tabs=detailsTab&gathStatTab=true&ct=display&fn=search&doc=ETOCRN262232382&indx=1&recIds=ETOCRN262232382. (Accessed 5 May 2022).

Hammond, D., Doxey, J., Daniel, S., Bansal-Travers, M., 2011. Impact of female-oriented cigarette packaging in the United States. Nicotine Tob. Res. 13 (7), 579.

Hammond, D., Wakefield, M., Durkin, S., Brennan, E., 2013. Tobacco packaging and mass media campaigns: research needs for Articles 11 and 12 of the WHO Framework Convention on Tobacco Control. Nicotine Tob. Res. 15 (4), 817–831. https://doi.org/10.1093/ntr/nts202.

Harris, J.E., Ares, G., Gerstenblüth, M., Machin, L., Triunfo, P., 2018. Impact of plain packaging of cigarettes on the risk perception of Uruguayan smokers: an experimental study. Tob Control 27 (5), 513–518. https://doi.org/10.1136/tobaccocontrol-2017-053639.

Hess, S., 2014a. Latent Class Structures: Taste Heterogeneity and beyond. *Handbook Of Choice Modelling*. Edward Elgar Publishing.
Hess, S., 2014b. Latent Class Structures: Taste Heterogeneity and beyond, pp. 311–329.
Hess, S., Hensher, D., Daly, A., 2012. Not bored yet - revisiting respondent fatigue in stated choice experiments. Transport. Res. Pol. Pract. 46 (3), 626–644. https://doi.org/10.1016/j.tra.2011.11.008.
Hoek, J., Gendall, P., Eckert, C., Louviere, J., 2016. Dissuasive cigarette sticks: the next step in standardised ('plain') packaging? Tobac. Control 25 (6), 699. https://doi.org/10.1136/tobaccocontrol-2015-052533.
Huang, L.-L., Thrasher, J.F., Reid, J.L., Hammond, D., 2016. Predictive and external validity of a pre-market study to determine the most effective pictorial health warning label content for cigarette packages. Nicotine Tob. Res. 18 (5), 1376.
Hughes, N., Arora, M., Grills, N., 2016. Perceptions and impact of plain packaging of tobacco products in low and middle income countries, middle to upper income countries and low-income settings in high-income countries: a systematic review of the literature. BMJ Open 6 (3), e010391. https://doi.org/10.1136/bmjopen-2015-010391.
Inza, F.S.M., Ryan, M., Amaya-Amaya, M., 2008. "Irrational" Stated Preferences: a quantitative and qualitative investigation. In: Ryan, M., Gerard, K., Amaya-Amaya, M. (Eds.), Using Discrete Choice Experiments to Value Health and Health Care. Springer, Netherlands, pp. 195–215.
Janssen, E.M., Marshall, D.A., Hauber, A.B., Bridges, J.F.P., 2017. Improving the quality of discrete-choice experiments in health: how can we assess validity and reliability? Expert Rev. Pharmacoecon. Outcomes Res. 17 (6), 531–542. https://doi.org/10.1080/14737167.2017.1389648.
Kotnowski, K., Fong, G.T., Gallopel-Morvan, K., Islam, T., Hammond, D., 2016. The impact of cigarette packaging design among young females in Canada: findings from a discrete choice experiment. Nicotine Tob. Res. 18 (5), 1348–1356. https://doi.org/10.1093/ntr/ntv114.
Lancsar, E., Fiebig, D.G., Hole, A.R., 2017. Discrete choice experiments: a guide to model specification, estimation and software. Pharmacoeconomics 35 (7), 697–716. https://doi.org/10.1007/s40273-017-0506-4.
Laverty, A.A., Millett, C., Hopkinson, N.S., Filippidis, F.T., 2021. Introduction of standardised packaging and availability of illicit cigarettes: a difference-in-difference analysis of European Union survey data 2015–2018. Thorax 76 (1), 89. https://doi.org/10.1136/thoraxjnl-2020-215708.
Lilic, N., Stretton, M., Prakash, M., 2018. How effective is the plain packaging of tobacco policy on rates of intention to quit smoking and changing attitudes to smoking? ANZ J. Surg. 88 (9), 825–830. https://doi.org/10.1111/ans.14679.
Llambí, L., Mauricio, M., Barros, M., Carolina, P., Gonzalez, P., Virginia, N., 2021. Cigarette flavours and design features available near schools before plain packaging implementation in Uruguay. Archives of Community Medicine and Public Health 146–150. https://doi.org/10.17352/2455-5479.000155.
Louviere, J.J., Hensher, D.A., Swait, J.D., 2000. Stated Choice Methods: Analysis and Applications.
Maldonado, N., Llorente, B.A., Iglesias, R.M., Escobar, D., 2020. Measuring illicit cigarette trade in Colombia. Tobac. Control 29 (Suppl. 4), s260. https://doi.org/10.1136/tobaccocontrol-2017-053980.
Mathers, C.D., Loncar, D., 2006. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 3 (11), e442 https://doi.org/10.1371/journal.pmed.0030442.
Ministerio de Salud y Proteccion Social, 2020. Colombia mantiene tendencia a la baja en consumo de tabaco. Updated 13 October. https://www.minsalud.gov.co/Paginas/Colombia-mantiene-tendencia-a-la-baja-en-consumo-de-tabaco.aspx. (Accessed 25 May 2022).
Moodie, C., Hastings, G., 2010. Tobacco packaging as promotion. Tobac. Control 19 (2), 168. https://doi.org/10.1136/tc.2009.033449.
Moodie, C., Hastings, G., Joossens, L., 2012. Young adult smokers' perceptions of illicit tobacco and the possible impact of plain packaging on purchase behaviour. Eur. J. Publ. Health 22 (2), 251–253. https://doi.org/10.1093/eurpub/ckr038.
Moodie, C., Hoek, J., Hammond, D., et al., 2022. Plain tobacco packaging: progress, challenges, learning and opportunities. Tobac. Control 31 (2), 263. https://doi.org/10.1136/tobaccocontrol-2021-056559.
Mutti, S., Hammond, D., Reid, J.L., Thrasher, J.F., 2013. The efficacy of cigarette warning labels on health beliefs in the United States and Mexico. J. Health Commun. 18 (10), 1180–1192. https://doi.org/10.1080/10810730.2013.778368.
Noar, S.M., Hall, M.G., Francis, D.B., Ribisl, K.M., Pepper, J.K., Brewer, N.T., 2016. Pictorial cigarette pack warnings: a meta-analysis of experimental studies, 2016-05-01 Tobac. Control 25 (3). https://doi.org/10.1136/tobaccocontrol-2014-051978, 341-341-342.
Rakotonarivo, O.S., Schaafsma, M., Hockley, N., 2016. A systematic review of the reliability and validity of discrete choice experiments in valuing non-market environmental goods. J. Environ. Manag. 183, 98–109. https://doi.org/10.1016/j.jenvman.2016.08.032.
Reed Johnson, F., Lancsar, E., Marshall, D., et al., 2013. Constructing experimental designs for discrete-choice experiments: report of the ISPOR conjoint analysis experimental design good research practices task force. Value in Health 16 (1), 3–13. https://doi.org/10.1016/j.jval.2012.08.2223.
Regmi, K., Kaphle, D., Timilsina, S., Tuha, N.A.A., 2018. Application of discrete-choice experiment methods in tobacco control: a systematic review. Pharmacoecon Open 2 (1), 5–17. https://doi.org/10.1007/s41669-017-0025-4.
Ross, H., 2015. Understanding and measuring cigarette tax avoidance and evasion: a methodological guide. https://tobacconomics.org/research/understanding-and-measuring-cigarette-tax-avoidance-and-evasion-a-methodological-guide/.
Rousu, M.C., Marette, S., Thrasher, J.F., Lusk, J.L., 2014. The economic value to smokers of graphic warning labels on cigarettes: evidence from combining market and experimental auction data. J. Econ. Behav. Organ. 108 https://doi.org/10.1016/j.jebo.2014.09.003, 123-123-134.
Ryan, M., Gerard, K., Amaya-Amaya, M., 2008. *Using Discrete Choice Experiments to Value Health and Health Care*. Economics of Non-market Goods and Resources. Springer.
Sillero-Rejon, C., Mahmoud, O., Tamayo, R.M., Clavijo-Alvarez, A.A., Adams, S., Maynard, O.M., 2022. Standardised packs and larger health warnings: visual attention and perceptions among Colombian smokers and non-smokers. Addiction 117 (6), 1737–1747. https://doi.org/10.1111/add.15779.
Stata Statistical Software: Release 17, 2018. StataCorp LP, College Station,TX.
Stead, M., Moodie, C., Angus, K., et al., 2013. Is consumer response to plain/standardised tobacco packaging consistent with Framework convention on tobacco control guidelines? A systematic review of quantitative studies. PLoS One 8 (10), e75919. https://doi.org/10.1371/journal.pone.0075919.
Stillman, F.A., Bone, L.R., Milam, A.J., Ma, J., Hoke, K., 2014. Out of view but in plain sight: the illegal sale of single cigarettes. J. Urban Health 91 (2), 355–365. https://doi.org/10.1007/s11524-013-9854-3.
Swayampakala, K., Thrasher, J.F., Hammond, D., et al., 2015. Pictorial health warning label content and smokers' understanding of smoking-related risks—a cross-country comparison. Health Educ. Res. 30 (1), 35–45. https://doi.org/10.1093/her/cyu022.
Thrasher, J.F., Pérez-Hernández, R., Arillo-Santillán, E., Barrientos-Gutiérrez, I., 2012. Towards informed tobacco consumption in Mexico: effect of pictorial warning labels in smokers. Hacia el consumo informado de tabaco en México: efecto de las advertencias con pictogramas en población fumadora. Salud Publica Mex. 54 (3), 242–253.
Tobacco Free Kids, 2022. Tobacco pack branding. Theory and practice. https://www.tobaccofreekids.org/plainpackaging/tools-resources/policy/tobacco-pack-branding-theory-and-practice. (Accessed 1 June 2022).
United Nations, 2022. WHO Framework convention on tobacco control. https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IX-4&chapter=9&clang=_en. (Accessed 25 May 2022).
United Nations Development Programme, 2019. The case for investing in WHO FCTC implementation in Colombia. https://www.co.undp.org/content/colombia/es/home/library/poverty/investment-case-for-tobacco-control-in-colombia.html.
van Mourik, D.J.A., Nagelhout, G.E., Poole, N.L., et al., 2022. Non-smoking adolescents' perceptions of dissuasive cigarettes. Addictive Behaviors Reports 15, 100433. https://doi.org/10.1016/j.abrep.2022.100433.
Vellios, N., 2022. Smoking cessation in South Africa: cigarette prices, plain packaging, and illicit trade. http://hdl.handle.net/11427/37039.
Wakefield, M., Morley, C., Horan, J.K., Cummings, K.M., 2002. The cigarette pack as image: new evidence from tobacco industry documents. Tobac. Control 11 (Suppl. 1), i73. https://doi.org/10.1136/tc.11.suppl_1.i73.
Wakefield, M.A., Hayes, L., Durkin, S., Borland, R., 2013. Introduction effects of the Australian plain packaging policy on adult smokers: a cross-sectional study. BMJ Open 3 (7), e003175. https://doi.org/10.1136/bmjopen-2013-003175.
White, C.M., Hammond, D., Thrasher, J.F., Fong, G.T., 2012. The potential impact of plain packaging of cigarette products among Brazilian young women: an experimental study. BMC Publ. Health 12 (1), 737. https://doi.org/10.1186/1471-2458-12-737.
WHO FCTC. Guidelines for implementation Article 13, 2013. World Health Organization FCTC/16.6. https://fctc.who.int/publications/m/item/tobacco-advertising-promotion-and-sponsorship.
WHO FCTC, 2021. The WHO Framework convention on tobacco control: an overview. https://fctc.who.int/publications/m/item/the-who-framework-convention-on-tobacco-control-an-overview.
WHO FCTC, 2022. 2021 global progress report on implementation of the WHO Framework Convention on Tobacco Control. https://fctc.who.int/publications/i/item/9789240041769.
World Health Organization, 2022. WHO tobacco fact sheet. Updated 24 May, 2022. https://www.who.int/en/news-room/fact-sheets/detail/tobacco.
Yoo, H.I., 2020. lclogit2: an enhanced command to fit latent class conditional logit models. STATA J. 20 (2), 405–425. https://doi.org/10.1177/1536867x20931003.
Zheng, Y., Zhen, C., Dench, D., Nonnemaker, J.M.U.S., 2017. Demand for tobacco products in a system Framework. Health Econ. 26 (8), 1067–1086. https://doi.org/10.1002/hec.3384.