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Effects of tobacco product type and characteristics on appeal and perceived harm: Results from a discrete choice experiment among Guatemalan adolescents

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ABSTRACT

Guatemala is one of the few countries where both heated tobacco products (HTPs) and electronic cigarettes (e-cigarettes) remain unregulated. We used a discrete choice experiment (DCE) administered to 2038 high school students to assess how tobacco product attributes influence their appeal among Guatemalan adolescents. Participants were randomly assigned to evaluate 4 of 32 contrasting sets, each containing 3 packs (1 of each product type). Experimental manipulations included: product type, brand, nicotine content and flavor. Participants then indicated which product they were most and least interested in trying and would be most and least harmful to their health. Conditional logistic regression models were used to assess the impact of product characteristics on choice. Product type accounted for almost 90% of variation in choices. Respondents were less interested in trying HTPs ($B = -0.93$; $p < 0.001$) and viewed them as more harmful ($B = 2.77$; $p < 0.001$) compared to cigarettes. They were more interested in trying e-cigarettes ($B = 1.22$; $p < 0.001$), which were also perceived as less harmful ($B = -1.47$; $p < 0.001$) compared to cigarettes. Products without nicotine were of more interest for trying ($B = 0.14$; $p < 0.001$) and perceived as more harmful ($B = 0.20$; $p < 0.001$) than those with. Students were more interested in trying a flavor compared to regular tobacco and among the flavors, berry was the highest rated one ($B = 0.28$; $p < 0.001$). Finally, in this country with weak tobacco control, e-cigarettes appear to be more appealing and perceived as less harmful than HTPs and cigarettes. Packaging and flavoring regulations are urgently needed on these products as they are a marketing strategy targeting adolescents.

1. Introduction

Worldwide, use of electronic cigarettes (e-cigarettes) and heated tobacco products (HTPs) continues to rise(Bialous and Glantz, 2018; Jamal et al., 2017; Kang and Cho, 2019; Miech et al., 2019; Pepper and Brewer, 2014). *E*-cigarettes use a battery to heat a liquid that usually contains nicotine and is available in over 7700 flavors(Chakma et al., 2019; Zhu et al., 2014). HTPs are electronic devices that heat (as opposed to burn) tobacco and produce an aerosol containing nicotine and, depending on the market, includes a limited number of flavor options(Simonavicius et al., 2019; WHO, 2018). As of May 2020, Philip Morris International (PMI) had introduced its HTP iQOS in 51 countries, including five Latin American countries where it is legally available, such as Guatemala (Phillip Morris International, n.d.; WHO, 2018).

Guatemala ratified the World Health Organization's Framework Convention on Tobacco Control (FCTC) in 2005 (World Health Organization, 2005), yet it has among the weakest tobacco control policies worldwide(Barnoya et al., 2016; World Health Organization, 2017) with a partially-compliant smoke-free environments law(Barnoya et al., 2016; Corral et al., 2011) and a non-compliant single cigarette sale ban (Ojeda et al., 2012). Additionally, it is one of the few countries where both e-cigarettes and HTPs are available without any labeling or nicotine restrictions(Johns Hopkins Bloomberg School of Public Health, 2020). iQOS is the only HTP available in Guatemala, although there are no data on adult HTP use. However, a recent study found 2.9% of high school students had used HTPs in the prior 30 days and 52.4% were aware of and susceptible to future use (Gottshclich et al., 2020), consistent with experiences elsewhere, such as South Korea (Kim et al.,

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2018).

First, second and third generation e-cigarettes and e-liquids are readily available and marketed in stores in Guatemala City (Chacon et al., 2018; Viteri et al., 2012). Most brands offer a variety of flavors and nicotine concentrations, most packaging has no warning labels, and some ads explicitly promote their use to "circumvent smoke-free environments" (Barnoya et al., 2020; Chacon et al., 2018). *E*-cigarette prices are relatively expensive compared to cigarettes, presenting cost barriers (Chacon et al., 2018). A 2015 report found that 5.6% of high school students are current e-cigarette users (World Health Organization, 2015), however, a 2019 study of middle and high socioeconomic (SES) urban areas, found that 27.7% use e-cigarettes(Gottshclich et al., 2020). Additionally, the percentage of youth who only smoke e-cigarettes and not conventional cigarettes is increasing(Gentzke et al., 2020; Gottshclich et al., 2020; Jamal et al., 2017; Weintraub, 2014). Data from the US and Latin America even suggests that e-cigarettes may appeal to some youth who would not otherwise have used tobacco products(Barrientos-Gutierrez et al., 2019; Barrington-Trimis et al., 2015; Dutra and Glantz, 2017; Gottshclich et al., 2020; Lozano et al., 2017; J. Thrasher et al., 2016), raising concerns given that e-cigarette use may prompt progression to conventional cigarette use(Aleyan et al., 2018; Barrington-Trimis et al., 2016; Lozano et al., 2017).

These products appear to appeal to youth partly because of perceptions that they are less harmful than cigarettes(Ambrose et al., 2014; Chaffee et al., 2015; Czoli et al., 2017; Pepper et al., 2014; Stratton et al., 2018). Premium brands can be misperceived as less harmful than cheaper brands (Czoli and Hammond, 2014) (Skaczkowski et al., 2017) and are associated with greater intentions to try them(Czoli and Hammond, 2014; Kotnowski et al., 2016; Salloum et al., 2018).

Flavors can also reduce risk perceptions and increase tobacco product appeal, particularly among youth(Abad-Vivero et al., 2016; Anderson, 2011; Barrientos-Gutierrez et al., 2020; Islam et al., 2018; Klausner, 2011; Kong et al., 2019; J. F. Thrasher et al., 2016a; Villanti et al., 2017b). Menthol may make it easier for youth to smoke by reducing throat and lung irritation (Krishnan-Sarin et al., 2017; Villanti et al., 2017a). A tobacco product innovation that has rapidly gained popularity worldwide, but particularly in Latin America, concerns flavor capsules in the filter that consumers can crush to flavor the smoke(Hoek et al., 2019; Thrasher et al., 2017). Most capsule cigarettes contain menthol, but in recent years have expanded to include berry, citrus, and even alcoholic beverage flavors(Moodie et al., 2019b; Thrasher et al., 2017). This variety of flavors appears to make cigarettes more appealing to adolescents and young adults(Abad-Vivero et al., 2016; Barrientos-Gutierrez et al., 2020; Moodie et al., 2018; J. F. Thrasher et al., 2016b). Furthermore, flavor capsules have been added to the tobacco sticks used for HTPs in some markets(Cho and Thrasher, 2019) but not yet in Guatemala.

Consumers generally recognize that nicotine makes tobacco products addictive, but mistakenly believe that nicotine is the primary source of harms from tobacco use(Denlinger-Apte et al., 2017; Justin Byron et al., 2018; O'Brien et al., 2017). The fact that adults increasingly view e-cigarettes as equally or more harmful than cigarettes appears, at least in part, due to misperceptions about nicotine(King et al., 2018; Majeed et al., 2017). Less is known about nicotine perceptions among youth, but their beliefs appear similar(East et al., 2018). Nevertheless, many youth believe that e-cigarettes do not contain nicotine, which may help explain increases in use(East et al., 2018; Vallone et al., 2019; Willett et al., 2019). Given emerging policy initiatives to reduce and even eliminate nicotine in tobacco products(Gottlieb and Zeller, 2017), it is important to clarify how nicotine influences the appeal and perceived harmfulness of diverse products among adolescents(Gottlieb and Zeller, 2017), including whether these influences vary by product type and flavor contents.

The current study used a discrete choice experiment (DCE) to assess how tobacco product type, flavors, and nicotine content influence appeal and risk perceptions among Guatemalan adolescents. Across products, attributes included both the standard nicotine level found in cigarettes (12 mg), as well as a no-nicotine option to reflect policy initiatives to ban nicotine in tobacco products, including reduction of nicotine to non-addictive levels in cigarettes(Gottlieb and Zeller, 2017). Similarly, governments around the world have increasingly banned flavors besides tobacco flavor, partly to reduce smoking among youth (Erinoso et al., 2020; Tobacco Free Kids, 2021), so we wanted to evaluate the appeal of non-tobacco flavors across diverse products. The flavors chosen reflected the primary categories found in flavor capsules that were also in e-cigarettes. We varied the brands for each product because such options make the choice task more representative of choices youth encounter in the marketplace, though this attribute was included primarily to make the task more naturalistic. To our knowledge, this is the first experiment of this type in a country where e-cigarettes and HTPs are readily available.

Table 1
Pack attributes and levels tested in the discrete choice experiment.

Attributes	Cigarette	Heated tobacco	*E*-cigarette
Brand	Marlboro	iQOS	VYPE
	Lucky strike	BLU	JUUL
Nicotine	None	None	None
	12 mg	12 mg	12 mg
Flavor	Tobacco	Tobacco	Tobacco
	Menthol	Menthol	Menthol
	Cherry flavor capsule	Cherry flavor capsule	Cherry
	Berry flavor capsule	Berry flavor capsule	Berry

2. Materials and methods

2.1. Sample

All students from 7th grade through high school (ages 13–18) in a convenience sample of eight private schools in Guatemala City were recruited to complete a self-administered, pencil and paper survey, between May and September of 2019. Following permission from each school principal, passive parental consent and active student assent were obtained. Survey questions were adapted from a study of Mexican adolescents (Barrientos-Gutierrez et al., 2020), with adaptation to Guatemalan Spanish and pilot testing among students from private schools not included in the current project. Study protocols were approved by the Institutional Review Board at the Central American Institute of Nutrition (INCAP) in Guatemala City.

2.2. Study design and protocol

DCEs use fractional factorial designs to create sets of alternatives from which participants choose. DCEs allow assessment of the independent effects of systematically manipulated stimulus characteristics on decision-making, including estimates of the relative impact of each characteristic on choices (Louviere et al., 2000). While the stimuli participants evaluate are often hypothetical, evidence indicates the external validity of results (Barber et al., 2019; Linley and Hughes, 2013; Mohammadi et al., 2017; Quaife et al., 2018), and DCEs are increasingly used to assess factors that influence tobacco product perceptions and behaviors(Barrientos-Gutierrez et al., 2020; Regmi et al., 2018; Thrasher et al., 2018).

We used a DCE with a 2x2x4 within-subject alternative specific block design with the three alternatives in each choice set including a different product (i.e., cigarette, HTPs, e-cigarette). Other systematically manipulated attributes included: brand (2 per product type); nicotine content (none, 12 mg); and flavors (tobacco, menthol, cherry, berry) (Table 1). Brands selected were those most prevalent in retailers at the time of data collection (i.e., Marlboro or Lucky Strike for cigarettes; iQOS or BLU for HTPs; VYPE or JUUL for e-cigarettes). For HTPs however, only iQOS was available, so we used an e-cigarette brand (Blu) that is unavailable in

Table 2
Participant characteristics of the total, analytic and excluded samples.

Characteristics	Total ($n = 2038$)	Interest in trying			Perceived harmfulness		
		Analytic ($n = 1713$)	Opted out[1] ($n = 325$)	p-value[2]	Analytic, ($n = 1952$)	Opted out[a] ($n = 86$)	p-value[b]
Sex				0.181			0.836
Female	48% (978)	49% (839)	45% (146)		48% (937)	47% (40)	
Male	52% (1060)	51% (874)	55% (179)		52% (1015)	53% (46)	
Age				0.078			0.105
13 or less	17% (346)	17% (291)	22% (71)		17% (331)	26% (22)	
14	24% (489)	23% (394)	26% (84)		23% (448)	29% (24)	
15	24% (489)	24% (411)	21% (68)		24% (468)	17% (14)	
16	20% (408)	20% (342)	18% (58)		20% (390)	16% (13)	
17 or more	16% (326)	16% (274)	13% (42)		16% (312)	12% (10)	
Smoking status				<0.001			<0.001
Non-susceptible, never smoker	63% (1284)	58% (993)	92% (299)		62% (1210)	85% (73)	
Susceptible, never smoker	8% (163)	9% (154)	2% (6)		8% (156)	8% (6)	
Tried but not current smoker	21% (427)	23% (394)	6% (19)		21% (409)	7% (6)	
Current smoker	8% (163)	10% (171)	0% (0)		9% (175)	0% (0)	
HTP status				<0.001			<0.001
Non-susceptible, never HTP user	69% (1406)	63% (1079)	96% (312)		68% (1327)	86% (73)	
Susceptible, never HTP user	22% (448)	25% (428)	3% (9)		22% (429)	11% (9)	
Tried but not current HTP user	7% (142)	8% (137)	1% (3)		7% (136)	2% (2)	
Current HTP user	3% (61)	3% (51)	0% (0)		3% (58)	1% (1)	
E-cigarette status				<0.001			<0.001
Non-susceptible, never e-cigarette user	42% (855)	35% (599)	78% (253)		41% (800)	70% (60)	
Susceptible, never e-cigarette user	9% (183)	10% (171)	3% (9)		9% (175)	9% (7)	
Tried but not current e-cigarette user	29% (591)	31% (531)	17% (55)		30% (585)	14% (12)	
Current e-cigarette user	20% (408)	24% (411)	3% (9)		21% (409)	7% (6)	

[a] Opted out indicates that the participant did not choose any options from any of the choice sets in the experiment and thus were excluded from the analysis.
[b] All *p*-values were calculated using chi-square tests.

Guatemala to depict the second HTP product. The most efficient design involved 32 choice sets; however, to minimize response burden, participants were randomly assigned to evaluate 1 of 8 blocks, each with 4 choice sets printed on a separate sheet of paper from the rest of the questionnaire (see Appendix D Figure). Systematic random ordering of choice sets within blocks aimed to reduce ordering effects.

2.3. Outcomes

"Best-worst" scaling was used, in which participants indicated which product in each choice set they were "most" and "least" interested in trying, as well as which they considered the "most" and "least" harmful to their health if they were to use it. Each set showed the three product types as well as a "no difference" option (see Appendix D figure for an example choice set). Participants could view each set for as long as they wished. Choices were used to derive paired comparisons for all combinations within a set (i.e., product 1 vs product 2; product 2 vs. product 3; product 1 vs. product 3). Products were coded as 1 if it was chosen as more interesting/harmful than its comparator product and 0 if less interesting/harmful. If participants selected the "no difference" option, both products within each pair were assigned a 0.

2.4. Participant characteristics

Participants reported their sex, age in years (13 or less, 14, 15, 16, 17 or more), and susceptibility to use, ever use, and last 30 day use of cigarettes, HTPs, and e-cigarettes. Susceptibility to use each product was assessed separately, with a single question (i.e., 'If one of your friends offered you a [heated tobacco product like IQOS/cigarette/e-cigarette], would you use it?'). As in prior research (Pierce et al., 1996), those who answered 'Definitely yes', 'Probably yes' or 'Probably no' were considered susceptible, whereas those who reported 'Definitely no' were not. Prior studies have found that this single indicator has similar predictive validity as the use of multiple questions (Morello et al., 2016). For each product type, participants were classified as a non-susceptible never user, susceptible never user, ever but not current user, or current users. Chi-square tests showed no significant differences in participant characteristics across blocks (results not shown) suggesting adequate randomization, and thus we did not adjust for these characteristics as covariates.

2.5. Data analysis

For each outcome (interest in trying, perceived harmfulness), only data from participants who selected at least one product as being more or less interesting/harmful across all choice sets were included in the analytic sample. This is common practice for DCEs, as the samples who "opt out" are effectively constant across all choice sets and only add to the error variance of the estimates. To understand the characteristics of students with no preferences across products evaluated (which is reasonable given the young age of our sample), we compared characteristics of those who were included in and excluded from the analytic sample using chi-square tests. To assess the impact of product attributes on choice, we used conditional logistic regression models controlling for repeated measures and block assignment. Dependent variables were product chosen for each outcome (interest in trying, perceived harmfulness) using pairwise comparisons of options within each choice sets (see "Outcomes," above). Independent variables included product attributes (product type, brand, nicotine content, and flavor), which were coded such that the reference level was the dominant or most common product attribute. We also tested for interactions between product attributes (i.e. product type by nicotine, product type by flavor, and flavor by nicotine). Each interaction was assessed in separate models that included a set of indicators representing the interaction of interest and the main effects for the other product attributes in the DCE. Sensitivity analyses were also conducted: 1. All models were re-run for the entire sample, including those who opted out of all choice sets they evaluated; (Appendix A); 2. Models integrated participant characteristics (sex, age, and susceptibility, ever use, and current use for cigarettes, e-cigarettes, and HTPs) as covariates (Appendix B); 3. Models were stratified by whether the participants had ever or never used any tobacco product (Appendix C). Across sensitivity analyses, the results were consistent in

Table 3
Main and interaction effects of product attributes on outcomes.

Product attributes	Interest, n = 1713	Perceived harmfulness, n = 1952
	Coef. (SE)	Coef. (SE)
Model 1: Main effects		
Product type		
Cigarette	Ref	Ref
Heated tobacco	−0.93 (0.19)***	2.77 (0.21)***
e-cigarette	1.22 (0.12)***	−1.47 (0.24)***
Brand		
0	Ref	Ref
1	−0.02 (0.03)	0.11 (0.03)***
Nicotine		
12 mg	Ref	Ref
None	0.14 (0.03)***	0.20 (0.04)***
Flavor		
Tobacco	Ref	Ref
Menthol	0.17 (0.04)***	0.03 (0.04)
Cherry	0.24 (0.04)***	0.14 (0.04)***
Berry	0.28 (0.04)***	−0.01 (0.05)
Model 2: Product type by nicotine interaction		
Product type x nicotine		
Cigarette, 12 mg	Ref	Ref
Cigarette, without nicotine	−0.12 (0.05)*	1.02 (0.07)***
HTP, 12 mg	−0.94 (0.19)***	2.97 (0.22)***
HTP, without nicotine	−1.05 (0.20)***	3.68 (0.22)***
e-cigarette, 12 mg	0.77 (0.13)***	0.27 (0.27)
e-cigarette, without nicotine	1.30 (0.12)***	−1.70 (0.29)***
Overall p-value	*<0.001*	*<0.001*
Model 3: Product type by flavor interaction		
Product type x flavor		
Cigarette, tobacco	Ref	Ref
Cigarette, menthol	−0.06 (0.06)	0.23 (0.08)***
Cigarette, cherry	−0.06 (0.07)	0.26 (0.07)***
Cigarette, berry	−0.06 (0.07)	0.06 (0.09)
HTP, tobacco	−0.69 (0.20)***	2.77 (0.22)***
HTP, menthol	−1.05 (0.20)***	2.93 (0.22)***
HTP, cherry	−1.13 (0.21)***	3.11 (0.22)***
HTP, berry	−1.15 (0.21)***	2.84 (0.22)***
e-cigarette, tobacco	0.56 (0.13)***	−1.07 (0.26)***
e-cigarette, menthol	1.19 (0.13)***	−1.53 (0.25)***
e-cigarette, cherry	1.37 (0.13)***	−1.39 (0.25)***
e-cigarette, berry	1.49 (0.13)***	−1.29 (0.25)***
Overall p-value	*<0.001*	*<0.001*

Coef. = coefficient; SE = standard error; Ref = reference level.*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
All models adjust for block. Interaction models also include the attributes not present in the interaction.

terms of the direction of effect, statistical significance and interpretation, so are not reported in detail. To determine the relative impact of each product attribute on choice, we calculated the difference between each attribute's highest and lowest estimated effect on choices (i.e. utility range) from the main effect models, where the reference level is zero. For example, looking at the interest outcome, the utility range for flavor is 0.28 (0.28–0). The utility range was then divided by the sum of all the attributes' utility ranges for a given outcome. For example, the relative importance of flavor was 0.28/2.60 = 0.11 or 11%. All analyses were conducted using the choice modelling package in Stata 16.

3. Results

3.1. Sample characteristics

Of the 2274 students invited to participate, 90% (n = 2038) answered the questionnaire, approximately half of whom were female (48%) and 14 or 15 years old (48%) (Table 2). Most participants were non-susceptible never smokers (63%), non-susceptible never HTP users (69%), and non-susceptible never e-cigarette users (42%). For the interest in trying outcome, 325 participants opted out of all choice sets, leaving 1713 in the analysis; for the perceived harmfulness outcome, 86 participants opted out leaving 1952 in the analysis. The analytic and excluded samples were similar in sex and age composition; however, the analytic samples included significantly lower proportions of non-susceptible never smokers, non-susceptible never HTP users, and non-susceptible never e-cigarette users and higher proportions of current smokers, current HTP users, and current e ($p < 0.001$ for all).

3.2. Effect of product attributes on choice

In the main effects model for interest in trying products (Table 3), students were more interested in trying e-cigarettes (b = 1.22) and less interested in trying HTPs (b = −0.93) compared to cigarettes. Students also were more interested in trying products without nicotine (b = 0.14) than with nicotine, as well as products with menthol (b = 0.17), cherry (b = 0.24) or berry (b = 0.28) than products with tobacco flavor. In models for relative harmfulness of products, e-cigarettes were less likely (b = −1.47) and HTPs more likely (b = 2.77) to be selected as harmful compared to cigarettes. Products without nicotine (b = 0.20) and those with cherry flavor (b = 0.14) were also more likely to be selected as harmful compared to products with nicotine and with tobacco flavor, respectively.

When examining the relative importance of each attribute on choices around interest in trying (Fig. 1), product type was most influential (83%), followed by flavor (11%), nicotine (6%), and brand (1%). For perceived harmfulness, product type also had the largest influence (90%), followed by nicotine (4%), flavor (3%), and brand (2%).

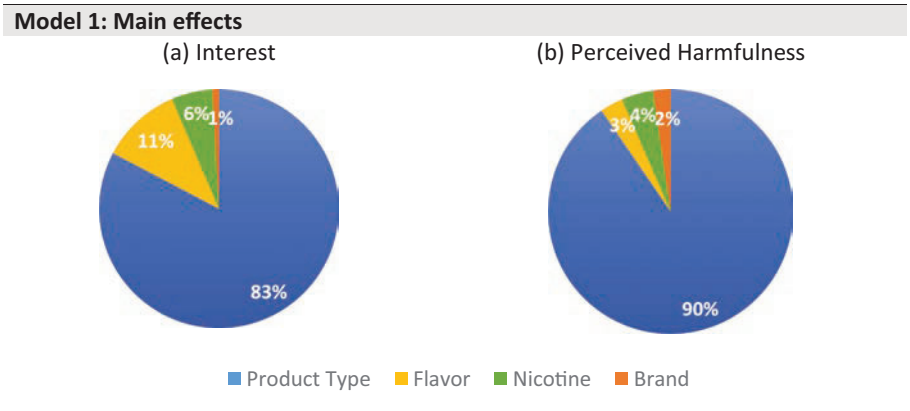

Fig. 1. Relative importance of product attributes on choice (color printed).

3.3. Interactions between product attributes

Product type significantly interacted with both nicotine and flavor (Models 2 and 3 in Table 3). Products without nicotine and with flavors other than tobacco were associated with higher interest in trying and lower perceptions of harmfulness for e-cigarettes whereas nicotine and flavor had either no or the opposite effect for cigarettes and HTPs. HTPs without nicotine were the least interesting for trial (b = −1.05) and most harmful (b = 3.68) compared to cigarettes with nicotine. The product type by flavor interaction indicated that e-cigarettes with berry flavor were the most interesting (b = 1.49) and HTPs with berry flavor the least interesting to try (b = −1.15). HTPs with cherry flavor were perceived as most harmful (b = 3.11) and e-cigarettes with menthol flavor were perceived as least harmful (b = −1.53), although estimates for all non-tobacco flavors of e-cigarettes were similar (ranging from −1.29 to −1.53).

4. Discussion

In this study we found that Guatemalan adolescents clearly perceive e-cigarettes as more appealing and less harmful than cigarettes, with HTPs perceived as the least appealing and most harmful product, which is contrary to what has been reported elsewhere for adults(Gravely et al., 2020; Tompkins et al., 2021). These findings are particularly relevant in Guatemala, since e-cigarettes are the most readily available(Chacon et al., 2018) and their sales are unrestricted. These results are consistent with patterns of product use in our sample, where many more students were current users of e-cigarettes (20%) than cigarettes (8% or HTPs (3%). It is important to point out, however, that the pattern of results was the same when we analyzed data only from students who had never used any tobacco product (Appendix C) suggesting that the appeal of e-cigarettes in this population is strong.

The influence of nicotine on product appeal and relative risk perceptions was less powerful and consistent. Overall, products without nicotine generated more interest in trial, but interactions indicated that this was limited to e-cigarettes, whereas cigarettes without nicotine and HTPs generated less interest than their counterparts with nicotine. A similar pattern was found for models of relative harmfulness, where perceived lower harm from eliminating nicotine was limited to e-cigarettes, whereas the inverse was true for cigarettes and HTPs.

Flavors also increased product appeal and influenced relative harmfulness perceptions, as in prior research(Islam et al., 2018), although the positive effects of flavors were most apparent for e-cigarettes. However, we found that flavor effects depend on the product evaluated. While berry was the most appealing flavor overall, consistent with previous studies(Abad-Vivero et al., 2016; Hoek et al., 2019; Moodie et al., 2019a), it was the least appealing flavor for cigarettes and HTPs. This may be due to familiarity with berry flavors in e-cigarettes, but not in cigarettes or HTPs. Finally, we found that menthol, while appealing compared to tobacco flavor, is less appealing than other flavor options, consistent with another DCE study among youth(Buckell and Sindelar, 2019).

These findings should be interpreted in light of some limitations. Our sample was drawn from private school students who mostly come from relatively high SES groups. Given that e-cigarettes and HTPs are more costly than regular cigarettes, they are likely less affordable for students from lower SES groups. Therefore, our findings around the very large appeal of e-cigarettes may not generalize other students, particularly those from lower SES groups who attend public schools. Also, given that we did not perform manipulation checks, it is not possible to verify that respondents based their choices on the differences between the attributes of interest; however, the presentation of these attributes was realistic, based on actual product packaging designs, had detectable effects on choices, and, as such, may nevertheless reflect how youth would respond to these products in real life. Additionally, the placement of attributes was not identical across products, as our graphic designer used existing products to ensure the believability of the presentations; therefore some participants may have interpreted some attributes to be less tied to the actual product, leading us to underestimate the effects of flavor and nicotine levels across product types. Future studies should consider this issue and potentially manipulate the salience of attributes to determine their effects. Finally, participants may have thought the nicotine and flavor attributes shown to be part of the packaging and not the product found inside, which would have led to underestimating the effects of these attributes; however, we view this as very unlikely.

5. Conclusions

To the best of our knowledge, this is the first DCE to examine all three products together among youth. In addition, our sample of adolescents includes not only users but also those susceptible to trying each product. We present evidence of the independent and interactive effects on novel nicotine products' attributes (brand, nicotine content and flavor effects) on appeal and risk perception among Guatemalan adolescents based on a discrete choice experiment. This paper shows the potential role distinct attributes have on how attractive a product is or how much it makes you think about the harm it may cause.

Finally, the identification of these products' attributes effects on adolescents' appeal and risk perception may orient tailored control policies for these nicotine products. These tailored policies are urgently needed and could potentially halt the epidemic at an earlier stage where most established smokers initiate trial and regular use.

Patient consent for publication

Not required.

Data availability

Data are available upon reasonable request.

Declaration of Competing Interest

Non-declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2021.106590.

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