A cigarette pack by any other color: Youth perceptions mostly align with tobacco industry-ascribed meanings

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1. Introduction

Tobacco companies have routinely included product descriptors such as "light," "mild," or "low tar" on cigarette packs to assuage consumer concerns about the health consequences of smoking; and evidence shows these false claims are considered true among adult consumers and youth (Bansal-Travers et al., 2011a; Dunn and Johnston, 1966; Evans et al., 1995; Hammond and Parkinson, 2009; Kropp and Halpern-Felsher, 2004; Mutti et al., 2011; Wakefield et al., 2002). To combat the influence of such descriptors, Article 11, Section 1a of the World Health Organization Framework Convention on Tobacco Control (FCTC) states that "tobacco product packaging and labelling" may not "create an erroneous impression" including use of descriptors such as "low tar," "light," "ultra-light," or "mild." More recently, the Family Smoking Prevention and Tobacco Control Act of 2009 (FSPTCA) banned the use of "…explicit or implicit descriptors that convey messages of reduced risk including "light," "mild," and "low…" (Ashley and Backinger, 2012; Borland et al., 2008; Doxey and Hammond, 2011; Evans et al., 1995; Ford et al., 2013; Greenland, 2015; Moodie et al., 2011; Moodie et al., 2012; Prevention FS, 2009) In response to implementation of the FCTC and FSPTCA, the tobacco industry has instituted a wide range of pack colors to circumvent these new restrictions (Bansal-Travers et al., 2011a; Bansal-Travers et al., 2011b; Connolly and Alpert, 2014; Cummings et al., 2002; Doxey and Hammond, 2011; Hammond and Parkinson, 2009; Moodie and Ford, 2011; Prevention FS, 2009; Wakefield et al., 2002). Industry documents show tobacco companies intentionally leveraged the influence pack colors have on people to attract new customers and instigate brand loyalty (Cheskin, 1965; Connolly and Alpert, 2014; Pugh, 2010). Not surprisingly, the assortment of colors used in cigarette packaging has again burgeoned in the face of new advertising restrictions (Bansal-Travers et al., 2011a; Connolly and Alpert, 2014; Cummings et al., 2002; Freeman et al., 2008).

The effectiveness of employing color variations on cigarette packs to influence consumer perceptions of the products' health risks and taste is borne out in the literature (Bansal-Travers et al., 2011a; Borland et al., 2008; Connolly and Alpert, 2014; Hammond and Parkinson, 2009; Hammond et al., 2009). For example, among adult smokers in the US, UK, and Canada, research has shown cigarette pack colors are associated with the now-banned brand descriptors (Bansal-Travers et al., 2011a; Bansal-Travers et al., 2011b; Connolly and Alpert, 2014; Hammond and Parkinson, 2009; Hammond et al., 2009). In both the U.S. and Canada, lighter or "whiter" packages are perceived as containing cigarettes with a smoother taste and less health risk compared to darker packs, and participants concerned with health overwhelmingly indicated they would purchase the lightest ("whitest") package (Bansal-Travers et al., 2011a; Hammond and Parkinson, 2009). Yong et al. (2011) compared perceptions of "light/mild" cigarettes among adult smokers in the U.S., Australia, Canada, and the U.K. before and after the removal of these terms (Hammond, 2010). They found only a temporary decrease in the proportion of people reporting these misperceptions (e.g., "light/mild"), suggesting the systematic replacement of the terms with "color differentials" and alternative descriptors helped maintain misperceptions and that to eliminate such beliefs requires further regulation (Hammond, 2010). One of the few studies to date that examined how youth interpret cigarette pack colors was conducted in the UK; in this study, both youth (mean age ≈ 15) and adult participants rated lighter/whiter colored packs as having lower tar and lower health risks (Hammond et al., 2009).

Studies with adults clearly show that they associate flavors and flavor characteristics and taste preferences with package colors, suggesting that plain packages are needed. Much of adults' ascription of cigarette descriptors to packs of a particular color is typically attributed simply to memory or to "legacy" (e.g., there are memories or legacies of exposure to descriptors on different colored cigarette packs). However, studies have not assessed whether adolescents, who represent people without such legacy understanding/memory, similarly attribute flavors or other characteristics to such colors. If perceptions of risk and taste

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Fig. 1. Marlboro pack images used in survey of adolescents (N = 528; mean age 17.5), presented one at a time with list of descriptors.

Table 1
Cigarette Pack-Colors and Associated Consumer Perceptions of Associated Cigarette Descriptors based on Tobacco-Industry Research and Top 3 Descriptors Ascribed to Each Pack Color among California Youth (N = 528; mean age = 17.5) 2016.

Pack color	Industry-identified descriptors[a]	Descriptors ascribed by participants	Proportion of participants and proportion of ascribed descriptors[b] N (%; %)
Black	Strong, rich, or full flavor	Extra strong	228 (43.2; 21.2)
		Rich	149 (28.2; 13.8)
		Strong	145 (27.5; 13.5)
Gold (National Cancer Institute, 2008)	Lower health risk, light	Rich	188 (30.1; 16.0)
		Smooth	159 (25.6; 13.5)
		Fine	127 (24.1; 10.8)
Green	Menthol, cool, fresh	Menthol	164 (31.1; 16.6)
		Medium	100 (18.9; 10.1)
		Blend 27 & Mild	92 (17.4; 9.3)
Red	Full, rich, satisfying, or strong flavor	Smooth	169 (32.0; 14.6)
		Strong	145 (27.5; 12.5)
		Rich	111 (21.0; 9.6)
Silver/Blue	Mild, smooth, or mellow flavor	Smooth	157 (29.7; 14.3)
		Ultra-light	139 (26.3; 12.7)
		Fine	108 (20.5; 9.8)

[a] Tabled descriptors were culled largely from (Lempert and Glantz, 2016) Lempert LK, Glantz S. Packaging color research by tobacco companies: The pack as a product characteristic. *Tob Control*. 2016. It should be noted there are many color variations in use by PMI and the tobacco industry in general and this list should not be considered exhaustive.
[b] There were 12 descriptors from which participants could choose as many as they wanted: *smooth, low tar, light tar, medium, Blend27, ultra-light, mild, fine, rich, strong, extra strong, and menthol.*

(e.g., flavor, strength) associated with cigarettes varies by pack color among youth as it does among adults, an argument could be made that plain packaging would aid in preventing youth uptake and continued smoking. To assess whether youth in California (N = 528) associate cigarette pack colors with banned brand descriptors as intended by the tobacco industry, we showed participants pictures of Marlboro packs in colors commonly used by Philip Morris in the U.S. and abroad together with a list of common brand descriptors and asked them to ascribe descriptors to each pack (Lempert and Glantz, 2016). Findings will inform tobacco regulators as they consider the costs and benefits of

implementing Article 11 of the FCTC, and for the FDA as they consider plain packaging for cigarettes and other tobacco products in the US.

2. Methods

2.1. Participants and procedure

Participants were recruited from 9th and 12th grade classes in ten California high schools with large and diverse populations with respect to race/ethnicity and socioeconomic status. Researchers visited the schools and invited all 9th and 12th graders to participate in a longitudinal study of tobacco-related perceptions, social norms, marketing, and use. Students were given study information and consent forms to read and share with their parents. Interested participants signed assent forms and returned signed parental consent forms. Study personnel returned to the schools a few days later to collect forms and answer questions. Approximately 4000 students were informed of the study; 1299 consented. Of those consented, 419 were ineligible due to incorrect or missing information; 772 (87.8%) completed the baseline survey. Data for this study (n = 528) derive from Wave 3 (N = 619) and represent all participants who completed the Wave 3 survey (85.3%). Data were collected from June through September 2016, one year after baseline and Wave 3 was the only time the items related to pack-colors were asked. Among Wave 3 participants the mean age was 17.5 (SD = 1.63); 65.2% identified as female; 28.3% identified as White, 24.8% Asian/Pacific Islander, 34.5% Hispanic, and 12.4% other. Participants received $20 for completing the Wave 3 survey. There were no differences between the overall sample and the analytic sample for this study in sex, age, e-cigarette ever-use status or race/ethnicity (all $p's$ > 0.20).

2.2. Cigarette packages

The colors of the Marlboro cigarette packs (images) were selected as representative of common brand colors. For ease of reference, these packs will be referred to as: "black", "gold," "green," "red," and "silver/blue" (See Fig. 1).

2.3. Measures

2.3.1. Demographics
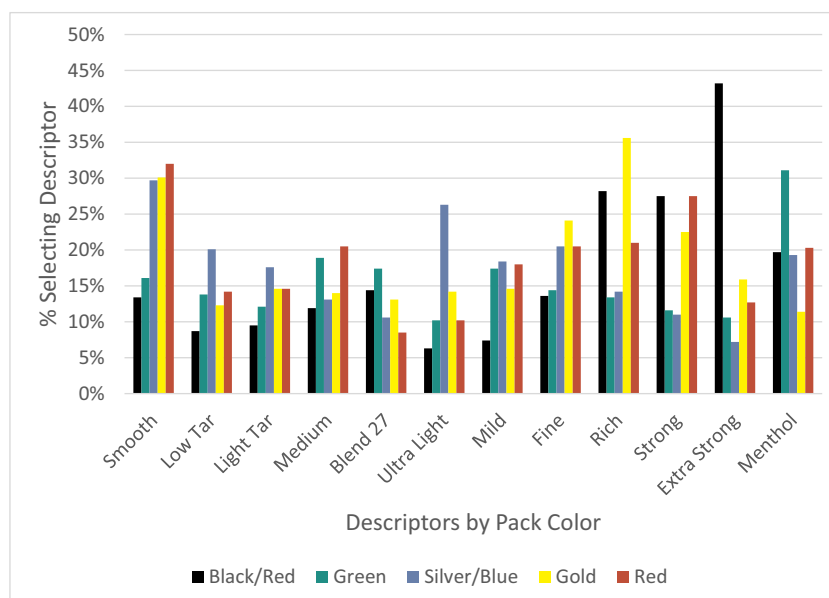Participants provided their age, sex, and racial/ethnic self-identity.

Fig. 2. Proportion of participants (N = 528; mean age 17.5) who chose each descriptor for all pack colors in 2016.

2.3.2. Ever-smoking

Participants were asked: During your entire life, how many times have you EVER smoked a cigarette, even 1 or 2 puffs. Response categories ranged from "never" to "100 or more times."

2.3.3. Perceived attributes of cigarette pack-colors

Participants were shown pictures of the *black, gold, green, red, and silver/blue* Marlboro cigarette packs described above. After viewing each pack, participants answered the question: Which of the following types or flavors of cigarettes does this package represent? (Select all that apply): "Blend 27," "extra strong," "fine," "light tar," "low tar," "medium," "menthol," "mild," "rich," "smooth," "strong," "ultra-light."

2.4. Analysis

Frequencies were run for all pack-color and attribute combinations. Next, in order to account for the fact that each respondent was able to select multiple attributes for each pack-color ("multiple response sets"), the frequencies were run conditional on the observed total number of participants selecting attributes for each pack color. Assuming some readers would be interested in frequencies conditional on the observed total number of participants selecting any pack color for each attribute and for ease of reporting and interpretation, these findings are presented in the supplemental materials. A priori, due to sample sizes, it was decided to not stratify analyses by smoker status or to conduct school-level cluster analysis (which has been shown in earlier analyses to be unrelated to any outcome variables of interest). Due to the small number of participants who reported having ever tried a cigarette (*n* = 88), smoker status was deemed unlikely to influence interpretation of findings in any meaningful way. Though school level factors could arguably contribute to changes in perception of pack-color, for ease of interpretation and reporting, we chose to report the individual-level bootstrap analysis described below; a similar analysis accounting for cluster-level did not meaningfully change the results presented in the manuscript.

We performed a stratified bootstrap analysis to assess the stability of the observed distribution of responses. Since students who reported having smoked in the past likely have a different experience with cigarette packs than those who did not, we chose to use participant reported smoking experience to stratify the sample for sample-proportionate bootstrap resampling. For example: there were 88 students who

indicated they had at least tried smoking cigarettes, so our bootstrap procedure used resampling to generate an overall dataset that had exactly 88 students who indicated they had at least tried smoking cigarettes. We report the results of 100,000 bootstrap samples.

While the bootstrap procedure can examine many measurements of variability, we focused on only two related measurements: (1) the percentage of time the actual data's observed mode descriptor was the most often picked descriptor (i.e., the mode) in the bootstrap samples, which illustrates how the population clearly holds this descriptor relative to the other candidate descriptors; and (2) the percentage of time the mode descriptor in the bootstrap samples was in agreement with one of the industry-expected descriptors for that packaging, which illustrates the level of agreement with the industry-expected communicated meaning there is in the population.

Analyses were conducted using SPSS version 24 and R Version 3.4.4.4.

3. Results

In general, participants' ascriptions of attributes to pack colors comported with industry-intended associations (Table 1) (Lempert and Glantz, 2016). In particular, 43.2% of participants (*N* = 228) attributed *extra strong* to the *black* pack, accounting for 21.1% of all responses ascribing any descriptor to *black* (*N* = 1076). Followed in descending order, 35.6% of participants (*N* = 188) ascribed *rich* to *gold* (representing 16% of 1174 responses); 32% (*N* = 169) *smooth* to *red* (14.6% of 1161); 31.1% (*N* = 164) *menthol* to *green* (representing 16.6% of 988 responses); 30.1% (*N* = 159;) *smooth* to *gold* (13.5% of 1174); and 29.7% (*N* = 157) of *smooth* to *silver/blue* (14.03% of 1098 responses; Figs. 2 and 3). For readers interested in the proportion of responses assigning pack color within each attribute, please see eTable 1 and eFig. 1.

Bootstrapping revealed that in line with industry expectations, the descriptors chosen most often (the "mode" response) for *green* and *black* were *menthol* and *extra strong*, respectively, 100% of the time. Moreover, for *silver/blue*, 89% of the time *smooth* was the mode descriptor with *ultra-light* the mode 12.4% of the time. With respect to the *red* pack, *smooth* was the mode 97.0% of the time, with the industry-expected descriptor *strong* a distant second (only 3.0% of the time was *strong* the mode of the responses). For *gold*, *rich* was the mode response 98.0% of the time (*smooth* 2.5% of the time). *Smooth* was first on the list
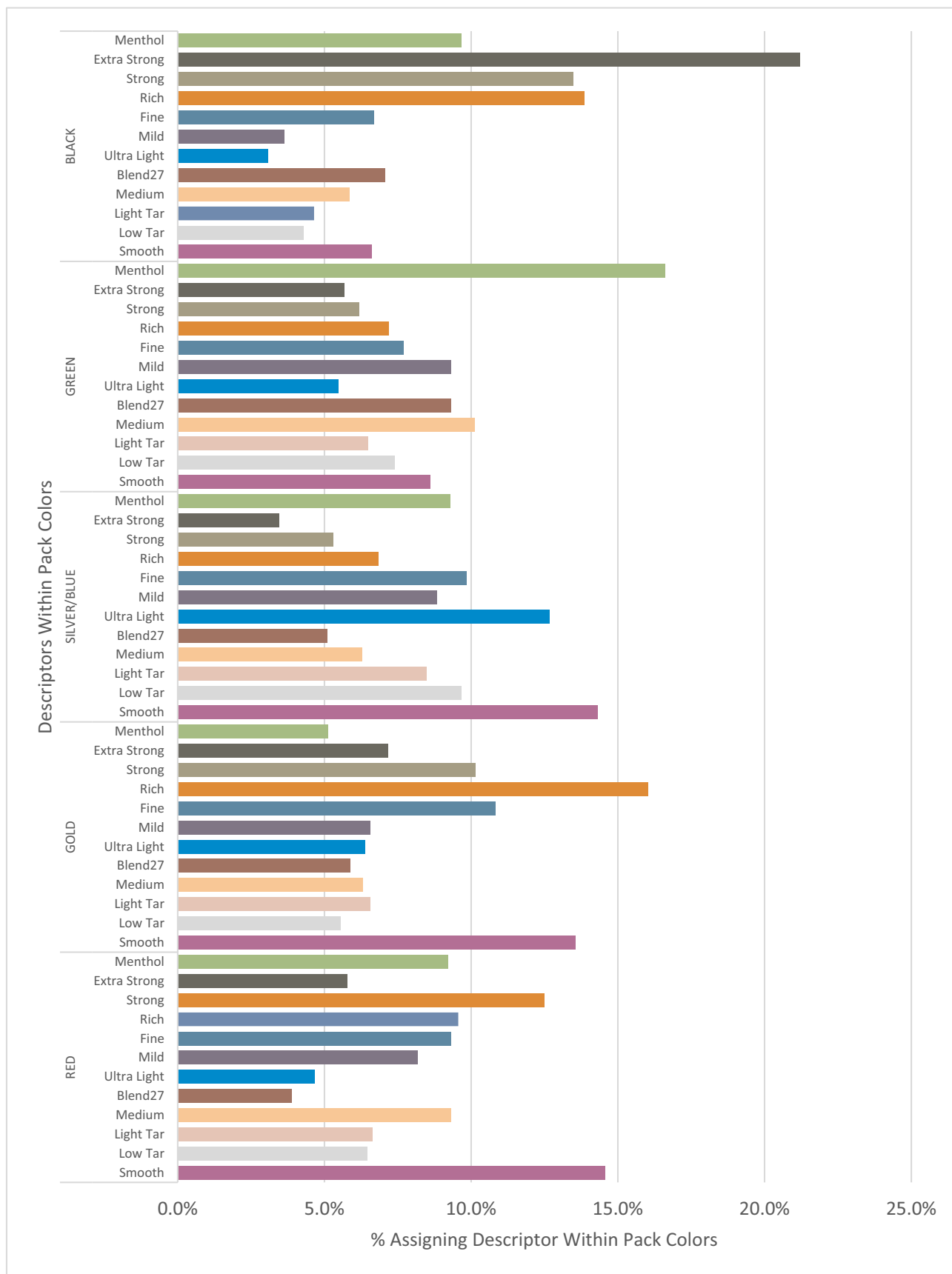
Fig. 3. Proportion of responses assigning descriptors for each pack color (N = 528; mean age 17.5) in 2016. Participants could choose as many descriptors as they felt applied, resulting in a different total number of responses for each pack color; the total number of responses received for each pack color was treated as 100%.

of descriptors participants could choose from, which could explain at least in part the primacy of *smooth* as a chosen descriptor for *red*.

4. Discussion

Descriptors attributed by participants to each pack most often aligned with industry-identified and intended color-related perceptions. Moreover, attribution of *rich* to golden packaging (i.e., *gold*) makes intuitive sense, especially in the absence of an alternative, known association. Attributed to the mostly white package (*silver/blue*) more often than to the remaining colors were descriptors indicative of less harmful cigarettes (i.e., *low tar, light tar, mild, and ultra-light*), which comports with findings among adult populations and with tobacco industry documents showing that whiter pack colors result in perceptions of lighter and less harmful cigarettes (Altria Sales and Distribution, 2010; Bansal-Travers et al., 2011a; Cheskin, 1965; Hammond and Parkinson, 2009; Lempert and Glantz, 2016; Yong et al., 2016). While none of the reported color-descriptor associations reached consensus among even half the sample, our bootstrapping results provide evidence of the robustness of our findings and left no doubt about which pack colors were seen as representative of the descriptors *rich, smooth, extra strong*, and *menthol*. It is important to note that of the bootstrapped pack-and-descriptor pairs, only the pairs *rich-gold* and *red-smooth* did not align with industry intent.

Youth interested primarily in flavors and taste are more likely to recognize flavor-related cigarette attributes (Aitken et al., 1987; Botvin et al., 1991; Goldstein et al., 1987). This notion is supported by the literature demonstrating that youth are particularly susceptible to and want to use flavored tobacco products (Ambrose et al., 2015). Further, menthol is the sole remaining flavor allowed in cigarettes on the U.S. market (Prevention FS, 2009). The association of green packaging with menthol cigarettes has likely been strengthened among youth, at least in part, by the targeting of youth with ads for menthol cigarettes, as has been shown with tobacco industry documents by Klausner (2011) (Klausner, 2011a), in a review by Huang et al. (2016) (Huang et al., 2016), and among others (Carpenter et al., 2005; Cruz et al., 2010; Huang et al., 2016; Klausner, 2011b; Richardson et al., 2015). Taken together, it is reasonable to suppose that tobacco companies have been successful in targeting youth through the use of flavored products and ads, who in turn associate package color with cigarette characteristics and flavors.

Findings should be interpreted within the limits of the study, including: results may not be generalizable to youth outside of California or the U.S.; only Marlboro packages were shown; and results may differ if packages for other cigarette brands were used. Further, the list of attributes employed was not an exhaustive list and there could be additional descriptor-color pairs; however, the color-descriptor pairs included have been widely researched and used by the tobacco industry.

In sum, the 2009 U.S. ban on the use of descriptive words such as *light* and *low tar* on cigarette packs may have been beneficial for youth. California youth in our study did not uniformly associate cigarette pack colors with specific strengths or tastes, which could signify a hard-won chasm between tobacco industry tactics and youth perceptions. That said, participants did associate *extra strong* flavor with *black* and *menthol* flavor with *green* while also indicating the "lightest" and "whitest" package (*silver/blue*) contained lighter cigarettes containing less tar, indicating a need for further regulation of pack-colors to eliminate the effects of package color on product perceptions (Lempert and Glantz, 2016; Moodie and Ford, 2011). In particular, more efforts are needed to restrict misleading descriptors that allude to health-effects and messages about flavors on packages as youth prefer flavored tobacco products and seek them out (Ambrose et al., 2015; Brown et al., 2014; Klein et al., 2008).

One way to eliminate the influence of color variation on consumer perceptions is for regulators to enforce the plain packing tenet of Article 11 of the FCTC in places where it has been ratified, and for the U.S.

Food and Drug Administration to mandate plain packaging. Among adults, plain-packaging of cigarettes has been found to dissuade perceptions of decreased harm and to be so unappealing they are consistently rejected in favor of more expensive, branded cigarettes (Cunningham and Kyle, 1995; Hammond, 2010; Hammond et al., 2009). This rebuff holds true among youth, who have been shown to perceive plain-packaged cigarettes as unappealing, harmful, indiscrete, and not intended for people their age (Ford et al., 2013; Germain et al., 2010; Hammond, 2010; Hammond et al., 2013; Hoek et al., 2013; Lunde, 2013; Moodie and Ford, 2011; Moodie et al., 2011; Moodie et al., 2012; Pechey et al., 2013; Van Hal et al., 2012).

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