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Evaluating US Smokers Willingness-to-Pay for Different Cigarette Packaging Designs Before and After Real-world Exposure in a Randomized Trial

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What this Paper Adds

What is already known on this subject:

- Graphic Warning Labels (GWLs) on cigarette packaging depicting the health consequences of smoking are not yet required in the United States.
- Tobacco industry marketing on branded cigarette packs generates appeal and contributes to incentive salience attribution thus increasing the perceived value of the product.
- Upon initial exposure, blank packaging which removes all appealing marketing features lessen the pack's perceived value while adding GWLs engenders aversion and further decreases a pack's apparent worth.

What important gaps in knowledge exist on this topic:

- Repeated exposure to GWLs may weaken the initial impact on cognitions and leave smokers desensitized to the imagery which should be reflected in how smokers value the products.
- Should wear-out effects occur, it is unclear if they are isolated to GWL imagery regularly seen or if wear-out effects extend more broadly to GWL images not regularly seen.
- Similarly, it is unknown if blank packaging which initially reduces the pack's perceived value suffers from an analogous type of wear-out .

What this study adds:

- Compared to current US packaging, GWL packaging consistently provoked independent strong aversive valuations both before and after allocation into an intervention in which smokers were assigned to purchase cigarettes from one of three pack conditions for 3-months (US branded packs without GWLs, non-branded blank packs without GWLs, and rotating blank packs with GWLs).
- Willingness-to-pay for blank packaging was slightly lower than that of current US packaging and this valuation did not change over the course of the randomized controlled trial. Smokers needed significant discounts (~\$-3.00) to willingly purchase GWLs over US pack designs, yet the need for large discounts begins to wear out among those randomized to purchase these same packs for 3-months. Desensitization effects do not appear to generalize to GWLs not regularly seen, indicating a need for regular refreshment of GWL content to maintain effects.

Abstract

Introduction: Removal of tobacco industry imagery from cigarette packs may reduce their appeal. Adding Graphic Warning Labels (GWLs) should enhance this effect. We investigate whether willingness-to-pay for various packaging designs change after 3-months use of: 1) US-branded packs without GWLs (US), 2) non-branded packs without GWLs (blank), and 3) rotating blank packs with GWLs (Gangrene; Throat Cancer; Neonatal Baby) covering >75% of pack (GWL).

Method: Californian adult daily smokers not planning to quit (N=287; 56% Female; Mean age=39.6) completed a discrete-choice task before and after 3 months experience using one of three packaging options. Conjoint analysis and pre-post modeling evaluated the change in importance of pack attributes and willingness-to-pay for US, Blank, or GWL (Blindness; Teeth; Gangrene) pack designs.

Results: Price determined ~70% of purchase choices, while pack design determined ~22%. Irrespective of intervention arm, US packaging generated appeal valuations compared to that blank packaging, while GWLs consistently provoked strong aversive valuations at baseline and follow-up. Compared to the US pack arm, using GWL packs for 3 months decreased willingness-to-pay for US packaging ($\beta=-0.38$ [95%CI=-0.76, 0.00]). Wear out effects were detected in the discount needed to willingly purchase the Gangrene-GWL packs ($\beta=0.49$ [95%CI=0.16, 0.82]), and Blank pack ($\beta=0.42$ [95%CI=0.09, 0.74]) arms, but not for GWLs (Blindness, Teeth) not used in trial.

Conclusion: The negative valuation of GWL packs compared to industry packs attenuates with even 3 months use, but doesn't generalize to non-used GWLs. This suggests that GWLs should be regularly refreshed. The appeal valuation of industry imagery suggests that the US plan to retain such imagery on packs will ameliorate the effect of GWLs.

Introduction

Although the US has mandated Graphic Warning Labels (GWLs) on cigarette packs¹ to start in July 2022,² tobacco industry litigation seeks to stop such ruling. GWLs use aversive imagery to remind smokers and non-smokers, especially youth,³ of the deleterious health consequences every time the smoker displays a pack.⁴ Plain or Blank packaging removes the industry's ability to use appealing marketing on packaging to encourage continued smoking⁵ or to entice non-smokers to initiate.⁶ Thus, removing industry imagery from cigarette packaging should weaken the perceived value of the product. Adding large aversive GWLs should further decrease the perceived value.⁷ We use a before and after willingness-to-pay measure to explore this potential decrease in perceived value among US smokers' randomized to have their cigarettes repackaged into different packaging options for 3-months.

Following an incentive salience model,⁸ the measurement of a smoker's willingness-to-pay for cigarette packs reflects in part how much the anticipatory drug reward combines with appealing product designs to capture attention and generate positive affect. Likewise, GWLs capture attention by provoking negative affect,^{9, 10} reducing appeal,¹¹ and increasing awareness of tobacco related health outcomes,¹² all of which are likely to reduce the value smokers place on these cigarette packs. Initial exposure to GWLs appear to reduce a smoker's willingness-to-pay for such products.¹³ However, willingness-to-pay after extended exposure will be a more important indicator of ongoing effects. Repeated exposure to GWLs may reduce the initial impact, leaving smokers emotionally and cognitively desensitized to the imagery.¹⁴ The extent of desensitization can be measured by the degree to which smokers devalue such products. Thus, we sought to examine if exposure to GWL packaging generates initial large, expected price

aversion valuations, and if sustained exposure to three months of consistent use of GWL plain packaging was associated with a weakening of price aversion. Further, as plain packaging removes industry marketing and adds GWLs, we sought to separate these two interventions and identify whether the perceived worth of blank packs devoid of marketing changes after three months of sustained exposure.

The California Smokers in Australia (CASA) randomized controlled trial, which examines the effects packaging has on smoking cognitions and behavior,¹⁵ obtained license for eight images used in Australia and selected three to rotate on re-packaging of US smokers' own cigarettes. In pre-trial measures, the 'Gangrene' image provoked the greatest negative affect and was perceived to be the most effective at communicating health risks^{15, 16} and was used in both the trial and the willingness-to-pay assessment. The trial rotated two other GWLs ('Throat Cancer' and 'Neonatal Baby'). Our willingness-to-pay assessment used two different images that were ranked similarly to 'Throat Cancer' on perceived effectiveness (i.e., 'Blindness' and 'Teeth Damage')¹⁵ to allow us to explore whether any trial effects on willingness-to-pay generalize to other GWL images.

Using a discrete-choice purchase task, we examined willingness-to-pay for five different packaging options: 1) standard US packs with industry branding and text-only health warnings; 2) a blank (or plain) pack devoid of industry imagery; 3) three plain packs with different GWLs covering 75% of the front and 90% of the back of pack. We hypothesized that 3-month exposure to their cigarettes in GWL packaging will result in amelioration of willingness-to-pay valuations. US smokers enrolled in the trial completed the purchase task both before and after completing the 3-month re-packaging intervention. Evaluating choice preferences allowed us to determine

the changes in price discount that individual smokers would need to be willing to purchase GWLs as compared to blank and current US packaging.

Methods

Study Population and Design: Participants were from the CASA randomized controlled trial examining the effects of cigarette packaging on smoking cognitions and behavior.¹⁵ Volunteer daily smokers from San Diego County, California who were aged 21-to-65 with no intention to quit in the next 30 days (to limit cessation during the trial's 1-month run-in period), were enrolled and signed informed consent (overseen by Institutional Review Boards at UC San Diego and Cal State San Marcos). We include only those who were randomized the CASA trial (n=357) and provided useable data on a purchase task both before and after the study intervention (n=287; **eFigure 1**). At baseline, participants completed a "think-aloud" pack handling task where they explored the different study packs and completed a discrete-choice purchase task to determine their willingness-to-pay for the different packaging designs (**Figure 1**). Following baseline measures, participants completed a one-month run-in period to assess compliance with study assessments and those who adhered were randomized into the CASA trial. The 3-month study intervention involved purchasing cigarettes in one of three packaging conditions: 1) blank or plain packs devoid of tobacco marketing (color matched to background on Australian GWL packs, referred to hereon as "Blank packs"); 2) GWL blank packs with images taking up 75% of the front and 90% of the back of the pack (we rotated 3 packs with the Gangrene, Throat Cancer and Neonatal Baby GWL images: **eFigure 2**, referred to hereon as "GWL packs"); and 3) standard branded US packs with their usual text-only warnings (referred to hereon as "US packs").

Measures

Willingness-to-Pay Purchase Task. At baseline and follow-up, an adaptive choice-based conjoint task^{17,18} evaluated willingness-to-pay for various pack designs. These discrete-choice tasks estimated the relative importance that smokers place on various cigarette pack attributes and the part-worth valuations of attributes levels. During the task, participants were exposed to a series of choices that involved different options that varied four attributes of the study pack. The first attribute was one of 5 different study packs (described below); the second attribute was the price asked for the pack (varies choices within $\pm 33\%$ of self-reported average cigarette pack price paid); the third attribute was whether the toll-free helpline number was included on the packages: the fourth attribute was whether the tobacco was domestic or imported. If, as expected, the latter two attributes did not influence willingness-to-pay, they would simply provide replications of other choice options. In the conjoint task, to test generalizability of the change in willingness-to-pay, we used three different GWL images that had been shown to elicit a range of emotional responses (i.e., Foot Gangrene, Teeth Damage and Blindness),¹⁵ only one of which, Gangrene, was used in rotation along with Throat Cancer and Neonatal Baby, in the 3 months GWL pack intervention arm (**eFigure 2**). Additionally, while the randomized trial repackaged participants own cigarettes, our budget limited the number of brand by pack design options we could develop for display. Thus, we asked participants to choose their preferred brand among the four most popular cigarette brands at the time (i.e., American Spirit, Camel, Marlboro, or Newport).¹⁹

Using an orthogonally balanced adaptive fractional factorial design,¹⁷ participants designed an ideal pack from the set of product attribute options. Then, a series of nine choice

tasks were presented, each assessing the possible purchase of three varied cigarette pack designs altered slightly from the ideal pack design. Finally, in a type of tournament of champions, up to 15 packs with purchase potential were pitted against one another until a single winner was identified. The trade-offs made during the task reveal the amount of utility (e.g., willing to pay more) or disutility (e.g., willing to pay less) associated with each design.

Study Covariates: We assessed sociodemographics (age, sex, race/ethnicity, and educational attainment),¹⁵ tobacco use (daily use frequency and primary brand smoked),¹⁵ the Fagerström Test of Nicotine Dependence scale,²⁰ and brand loyalty,²¹ as planned covariates. Brand appeal measured the participants' level of agreement with each of six-word characterizations ('The design on the brand of cigarettes I currently smoke is...Stylish, Fashionable, Cool, High quality, Attractive, and Appealing') using a 6-point Likert scale.^{22, 23}

Analytic Plan

To determine differences in a willingness-to-pay for packaging options, Hierarchical Bayesian conjoint analyses consisting of 40,000 iterations were conducted in Lighthouse studio (version 9.10.1). Choice data from four brand specific conjoint tasks (i.e., American Spirit, Camel, Marlboro, or Newport) were pooled with brand preference (i.e., matches brand vs. else) included as a covariate. Estimated part-worth utilities are relative, sum to zero, and represent the preference for each level of the package design attribute, with higher values indicating greater preference. The valuation of attribute levels was determined by dividing the difference in price anchors (\$3.00–\$15.00, i.e., the spread in variation of reported cigarette pack prices) by the difference in part-worth utilities for these anchors and then multiplying the median of this calculation across each utility score. Positive price utilities reflect an increased willingness-to-

pay for appealing pack features while negative price utilities reflect the discount needed to willingly purchase packs with aversive features. Importance scores reflect the maximum effect an attribute has on product choice and were generated by dividing range in utility scores by the sum of the ranges of all attributes.

Explanatory models were run in R version 4.0.3.²⁴ To investigate change in attribute importance and willingness-to-pay for each pack design, separate dependent samples t-tests, bootstrapped using 10,000 replications, were run using the “MKinfer” package.²⁵ A pre-post design was used to examine differences in willingness-to-pay for each pack design by study arm.²⁶ Five separate ordinary least squares regression models were fit to predict changes in willingness-to-pay. These were bootstrapped using 10,000 replications to obtain 95% confidence intervals. Models included the respective baseline willingness-to-pay score and the intervention condition as the independent regressor of interest with the current US arm set as the referent group. To adjust for potential confounding, age, gender, race/ethnicity, education, cigarette brand preference, nicotine dependence and brand appeal were included in the models. Post-intervention estimated marginal means of willingness-to-pay by intervention arm were computed from model terms using the “effects” package²⁷ and then plotted.

Results

Study Sample: A total of 357 smokers completed both study visits. Of these, 70 were excluded from the analysis: 40 had incomplete data, 12 had inconsistent choice preferences and thus categorized as likely not meaningful,²⁸ and 18 had responses that were outliers²⁹ on the conjoint task (4+ standard deviations above the mean). Among the analytic sample (n=287, **eTable 1**), 160 (56%) were female with a mean age of 39.6 years (SD=11.8). Over two thirds

were non-Hispanic White (69.3%) with the rest either Hispanic (10.5%) or other non-Hispanic race-ethnicities (20.2%). The majority of the sample received at least some college education (87.8%) with nearly half having earned a college degree (43.9%). Prior to the study, participants reported paying an average of \$8.13 (SD=\$1.48) per pack of 20 cigarettes and smoking just over half-a-pack per day (Mean=11.8, SD=6.0). Just over a quarter (26.8%) had high levels of dependence (FTND score ≥ 6) and less than a third (31.0%) had low dependence levels (FTND score ≤ 2). The highest proportion indicated that they were Marlboro smokers (42.5%) followed by Camel smokers (28.2%) and American Spirit smokers (16.7%).

Change in the Importance of Cigarette Pack Prices and Packaging. Participants indicated price was the key determining factor in purchasing cigarette packs and this importance remained unchanged from the baseline to post-intervention follow-up (69.4% \square 71.0% of choice decisions, respectively; **Table 1**). Packaging design was the second most important determinant in purchasing decisions and slightly declined by the end of the study (Baseline=24%, mean change=-1.87% [95%CI=-3.61%, -0.12%]). Both the origin of the tobacco (3.8% \square 4.3%) and the inclusion or exclusion quitline number (2.8% \square 2.7%) were considered rarely, although the importance of the tobacco origin increased slightly during the intervention (Mean change=0.54% [95%CI=0.17%, 0.91%]).

Baseline Willingness-to-Pay for Cigarette Packaging. At baseline, smokers were unaware of which arm they would be randomized to in the trial. Yet, initial willingness-to-pay estimates differed among the randomly allocated groups (**Table 2**). willingness-to-pay Nevertheless, irrespective of intervention arm randomization, GWL imagery consistently provoked strong aversive valuations (‘Gangrene’ image range: -\$2.06 to -\$1.52; ‘Teeth Damage’ image range: -

\$1.24 to -\$0.88; ‘Blindness’ image range: -\$0.80 to -\$0.65) compared to US branded imagery (range: \$1.69 to \$2.22); a pattern which remained consistent following the 3-month intervention.

Change in Willingness-to-Pay for Industry Branded Packaging. Willingness-to-pay for the current US pack remained unchanged following the three-month intervention among smokers in the US arm of the trial (appeal valuation change=-\$0.02 [95%CI=-\$0.28, \$0.24]; **Table 2**). Post intervention, a reduced willingness-to-pay for current US packaging was seen among those randomized to the GWL arm (appeal valuation change=-\$0.27 [95%CI=-\$0.52, -\$0.03]) and Blank pack arms (appeal valuation change=-\$0.46 [95%CI=-\$0.77, -\$0.13]) of the trial. After adjustment for baseline willingness-to-pay valuations and potential confounders, results showed that appeal valuations for US packs decreased during the intervention among those in the GWL pack arm (β =-0.38 [95%CI=-0.76, -0.00]) compared to smokers in US arm of the trial (**Table 3**). Post intervention estimated marginal means showed that the perceived value of current US packaging was lowest among those in the GWL pack arm (appeal valuation=\$1.54 [95%CI=\$1.27, \$1.81]) followed by those in the Blank pack arm (appeal valuation=\$1.58 [95%CI=\$1.32, \$1.85]) and US pack arm (appeal valuation = \$1.92 [95%CI=\$1.66, \$2.18]) study arms (**Figure 2**).

Change in Willingness-to-Pay for Blank Packaging. For each arm, in both unadjusted and adjusted analysis, willingness-to-pay for blank packaging did not change post intervention (GWL pack arm: post intervention adjusted marginal mean=\$1.40 [95%CI=\$1.14, \$1.66]; Blank pack arm: post intervention adjusted marginal mean=\$1.42 [95%CI=\$1.16, \$1.67]; US pack arm: post intervention adjusted marginal mean=\$1.67 [95%CI=\$1.42, \$1.92]; **Figure 2**).

Change in Willingness-to-Pay for GWL Packaging. Among those randomized to the GWL arm of the trial, aversion valuations for the ‘Gangrene’ GWL pack weakened following three-month exposure to the same imagery (unadjusted valuation change=\$0.49 [95%CI=0.26, 0.72]; **Table 2**). The same was not the case for the GWL imagery not used in the intervention (‘Teeth damage’ pack unadjusted valuation change=-\$0.20 [95%CI=-0.40, -0.01]; ‘Blindness’ pack unadjusted valuation change=\$0.05 [95%CI=-0.11, 0.20]). Those in the Blank pack arm also had weakened aversion valuations to the ‘Gangrene’ GWL pack following the intervention (unadjusted valuation change= \$0.69 [95%CI=0.42, 0.97]). Those in the US pack arm did not change their valuations of the ‘Gangrene’ or ‘Blindness’ GWL packs, although their aversion valuation for ‘Teeth Damage’ GWL pack increased (unadjusted valuation change= -\$0.26 [95%CI=-\$0.46, -\$0.07]). After adjustment for baseline willingness-to-pay and potential confounders, aversion valuations for the ‘Gangrene’ pack weakened over time among those in the GWL ($\beta=0.49$ [95%CI=0.16, 0.82]) and Blank ($\beta=0.42$ [95%CI=0.09, 0.74]) arms as compared to the US arm of the trial (**Table 3**). By intervention end, the US arm would need the greatest discount to willingly purchase the ‘Gangrene’ pack (post intervention adjusted marginal mean =-\$1.61 [95%CI=-\$1.84, -\$1.38]) followed by the Blank (post intervention adjusted marginal mean =-\$1.19 [95%CI=-\$1.42, -\$0.96]) and GWL (post intervention adjusted marginal mean =-\$1.12 [95%CI=-\$1.35, -\$0.89]) arms (**Figure 2**).

Discussion

When determining initial purchase choices among adult US daily smokers, we found price to be the most important factor (~70% of decision) followed by packaging design (~24% of decision). After first exposure to plain or blank packs with >75% GWL coverage, smokers were

found to be price averse to these products and to need sizeable discounts (e.g., ~\$-3.11) to willingly purchase GWL packs over their current US pack. As expected, US packs containing industry imagery generated considerable appeal valuations. When industry imagery was removed (i.e., blank packaging), we confirmed previous research³⁰ showing that valuations lessened with smokers needing small discounts (e.g., ~\$0.39) to willingly purchase a blank pack over a US branded pack. After adjusting for baseline valuations, the post-intervention assessment showed that price remained the dominant attribute in willingness-to-pay but pack design diminished slightly in importance.

There was no change in willingness-to-pay among participants assigned to the standard US pack group. Thus, this group provided a test-retest reliability for the measure as well as serving as the appropriate control for the other intervention groups. For all participants, in both pre and post assessments, current US packaging remained appealing and generated positive valuations.

Post-intervention, participants in the Blank pack arm remained unchanged in their willingness-to-pay for all but one pack design. After three months use of blank packaging, the discount needed to willingly purchase the 'Gangrene' GWL pack significantly diminished. However, the baseline price aversion for the 'Gangrene' pack was much higher in this trial arm than the other two arms. Post-intervention, the price aversion estimates for smokers in the blank pack arm fell to levels that more closely aligned with the other arms. This suggests that these results might simply reflect regression to the mean.³¹ Further examination of how packaging devoid of industry imagery impacts the perceived value of packs with GWLs is warranted.

Among those randomized to the GWL pack arm of the study, the discount needed to willingly purchase the ‘Gangrene’ pack (the one GWL that was also included in the 3-month study repeated exposure intervention) declined in the post-intervention assessment. This suggests desensitization or potential wear-out effects from repeated exposure to this GWL image. However, there was no change in the discount needed to willingly purchase the alternate GWL packs not in the 3-month intervention (i.e., ‘Blindness’ and ‘Teeth Damage’). This suggests that desensitization effects may be specific to repeated exposure which may be overcome by regular refreshment of the GWL images used. Further, those in the GWL pack arm were less willing to pay for current US packaging following the intervention. It is plausible that repeated exposure to GWLs disrupted incentive salience attribution and led to a reduction in the value placed on appealing pack designs.^{8,32} Of note, nicotine dependence was not strongly associated with these effects.

Overall, the impact GWLs had on product price perceptions was approximately equivalent to a substantial \$3.00 excise tax increase in this California sample who reported paying ~\$8.00 per pack of 20 cigarettes on study entry. However, this estimate may not generalize well to other locations as the price of cigarettes is lower in California than it is in some other US states³³ or other countries such as Australia.^{34,35} Of note is the fact that aversion valuations for GWL packs began to slightly wane after a relatively short period of exposure (3-months). This fits with the results of the main CASA trial where the GWL intervention reduced positive perceptions of cigarettes, increased health concerns, increased quitting cognitions and slightly increased periods of cigarette abstinence per week but not smoking behavior compared to the US pack arm.³⁶ While CASA study findings are consistent with research from 60 countries

showing a lack of a definitive association between implementation of GWLs and reductions in smoking prevalence,³⁷ a 2017 Cochrane review concluded that a behavioral effect may have been attributable to the introduction of GWLs in Australia.³⁸

These results are subject to certain limitations. Despite the ecological validity of conjoint tasks,¹⁸ price valuations tend to overstate the amount that consumers would actually pay in the marketplace. We attempted to correct for exaggerated willingness-to-pay by centering the price per utility at the sample median before multiplying across attribute level utilities. While the CASA study's randomization allowed for within arm willingness-to-pay change analyses, study groups were not balanced on this measure as it was not used in the stratification, so we controlled for these baseline differences in analyses. Generalizability to the population of Californian and US smokers is limited due to the sample being highly educated and recruited from San Diego, California which has stronger social norms and less smoking behavior than other US states.³⁹ The trial only sampled current daily smokers with no immediate quit intentions and thus we are unable to estimate the impact that GWLs have on the potential purchase decisions of either non-daily smokers, susceptible non-smokers,⁶ or smokers ready to quit. (REF) Budget constraints meant that we were limited to using the four most popular brands for our willingness-to-pay task which meant that 8.7% of study participants were asked to choose a brand that was different than their preferred brand for use in the task. We expect that this increased the variability in our assessments. The GWL plain packaging used in this study is not the same hybrid packaging proposed for use in the US which contains both industry marketing with GWLs limited to 50% of packs.² Given the results of this study, we would expect that the inclusion of appealing industry imaging would ameliorate the aversion engendered by the GWL images.⁴⁰

Notwithstanding these limitations, the study has numerous strengths. We followed prior recommendations⁴¹ by capturing data on brand smoked, modifying the packaging of those brands, and anchoring choice options around the prices paid regularly for packs. This approach allowed us to isolate the effects that pack design attributes have on product valuations. We also used an adaptive fractional factorial design in the price task to efficiently estimate willingness-to-pay across the full factorial set of pack attributes. In an effort to anchor choices to actual products, we exposed participants to the packaging by allowing them to handle the designs for several minutes prior to completion of the first price task. We then assigned them to purchase their cigarettes packaged in one of these design variants for 3-months before once again completing the willingness-to-pay assessment.

Conclusion

Compared to current US packaging which generates appeal and adds to the value of the product, GWL packaging covering >75% of the pack engenders price aversion and thus represents a loss in perceived product value. Yet this effect begins to wear out after a relatively short 3-month exposure to obtaining cigarettes in GWL packs, indicating a need for ongoing refreshment of GWL images. Future studies are needed to determine whether these results translate to hybrid style packaging used in other countries and proposed by FDA for implementation in the US.

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Table 1. Change in Cigarette Pack Attribute Importance after 3-month Packaging Invention (N=287).

Attribute ¹	Relative Importance		Difference in importance ²
	Baseline	Follow-Up	
Price	69.40 (68.49, 70.31)	70.96 (69.98, 71.95)	1.38 (-0.49, 3.24)
Packaging	24.07 (23.21, 24.92)	22.03 (21.10, 22.97)	-1.87 (-3.61, -0.12)*
Tobacco origin	3.78 (3.62, 3.95)	4.33 (4.16, 4.50)	0.54 (0.17, 0.91)**
Quitline	2.75 (2.63, 2.87)	2.68 (2.59, 2.76)	-0.05 (-0.32, 0.22)

Note. Data expressed as mean (95% confidence intervals).

¹ Attributes represent the different product characteristics of the cigarette pack (i.e., price, packaging, quitline number and tobacco origin) and importance scores reflect the relative weight of an individual attribute in comparison with other attributes, with scores summing to 100.

² From bootstrapped dependent samples t-tests (n=10,000).

* $p < .05$ ** $p < .01$, *** $p < .001$.

Table 2. Change in Price Utilities of Cigarette Pack Designs by Intervention Arm among Daily Smokers (N=287)

Packaging design	US Branded Pack Arm (N = 95)		Blank Pack Arm (N = 97)		GWL ¹ Pack Arm (N = 95)	
	Price utility at baseline ²	Change in price utility at follow-up ³	Price utility at baseline ²	Change in price utility at follow-up ³	Price utility at baseline ²	Change in price utility at follow-up ³
	Mean	Δ (95%CI)	Mean	Δ (95%CI)	Mean	Δ (95%CI)
US branded	\$1.92	-\$0.02 (-0.28, 0.24)	\$2.22	-\$0.46 (-0.77, -0.13)**	\$1.69	-\$0.27 (-0.52, -0.03)*
Blank	\$1.51	\$0.13 (-0.11, 0.37)	\$1.81	-\$0.22 (-0.51, 0.07)	\$1.35	-\$0.06 (-0.30, 0.20)
Blindness	-\$0.80	\$0.11 (-0.04, 0.25)	-\$0.74	-\$0.02 (-0.18, 0.14)	-\$0.65	\$0.05 (-0.11, 0.20)
Teeth damage	-\$1.03	-\$0.26 (-0.46, -0.07)*	-\$1.24	\$0.01 (-0.24, 0.24)	-\$0.88	-\$0.20 (-0.40, -0.01)*
Gangrene	-\$1.60	\$0.05 (-0.18, 0.28)	-\$2.06	\$0.69 (0.42, 0.97)***	-\$1.52	\$0.49 (0.26, 0.72)***

Note. Data expressed as Mean or Mean Δ (95% confidence intervals).

¹ GWLs included in 3-month intervention arm included Gangrene; Throat Cancer; Neonatal Baby warnings.

² Utility scores represent the preference for each packaging design and dollar valuation associated with that preference, with positive values indicating a relative willingness-to-pay more for the packaging and negative values representing the discount needed to purchase the packaging.

³ From bootstrapped dependent samples t-tests (n=10,000). * $p < .05$ ** $p < .01$, *** $p < .001$

Table 3. Differences in Cigarette Pack Design Price Utilities by Intervention Arm Following 3-months of Exposure to Study Packaging (N=287)

Regressor	Outcome: Pack Price Utility (i.e., Willingness-to-pay) ¹				
	Current US	Blank	Blindness	Teeth Damage	Gangrene
3-month intervention arm					
<i>US pack</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
<i>Blank pack</i>	-0.34 (-0.72, 0.04)	-0.25 (-0.62, 0.11)	-0.07 (-0.27, 0.12)	0.20 (-0.09, 0.49)	0.42 (0.09, 0.74)*
<i>GWL² pack</i>	-0.38 (-0.76, -0.00)*	-0.27 (-0.64, 0.10)	0.01 (-0.19, 0.20)	0.18 (-0.12, 0.47)	0.49 (0.16, 0.82)**
Baseline WTP	0.58 (0.46, 0.70)***	0.63 (0.51, 0.76)***	0.38 (0.25, 0.51)***	0.56 (0.44, 0.69)***	0.51 (0.40, 0.63)***
Covariate Controls					
Age (years)	0.01 (-0.01, 0.02)	0.01 (-0.01, 0.02)	-0.00 (-0.01, 0.00)	-0.00 (-0.01, 0.01)	-0.01 (-0.02, 0.00)
Sex					
<i>Male</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
<i>Female</i>	-0.08 (-0.41, 0.25)	-0.06 (-0.39, 0.26)	-0.05 (-0.22, 0.12)	0.06 (-0.20, 0.31)	-0.00 (-0.29, 0.29)
Race/Ethnicity					
<i>White, non-Hispanic</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
<i>Hispanic</i>	-0.16 (-0.68, 0.36)	0.04 (-0.46, 0.54)	0.02 (-0.24, 0.29)	0.01 (-0.38, 0.41)	0.08 (-0.36, 0.53)
<i>Other, non-Hispanic</i>	0.22 (-0.17, 0.61)	0.20 (-0.17, 0.58)	-0.17 (-0.37, 0.03)	-0.14 (-0.44, 0.16)	-0.12 (-0.46, 0.22)
Education					
<i>College degree or more</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
<i>Some college</i>	-0.06 (-0.39, 0.27)	-0.09 (-0.41, 0.23)	-0.02 (-0.19, 0.15)	0.14 (-0.12, 0.39)	0.00 (-0.28, 0.29)
<i>High School or less</i>	0.10 (-0.42, 0.62)	-0.10 (-0.61, 0.40)	0.06 (-0.21, 0.32)	0.16 (-0.24, 0.56)	-0.16 (-0.61, 0.29)
Cigarette Brand					
<i>Marlboro</i>					
<i>American Spirit</i>	0.02 (-0.41, 0.45)	-0.04 (-0.45, 0.38)	-0.30 (-0.52, -0.08)**	0.08 (-0.25, 0.41)	0.30 (-0.07, 0.67)
<i>Camel</i>	-0.09 (-0.47, 0.28)	0.03 (-0.32, 0.38)	0.17 (-0.02, 0.36)	-0.06 (-0.34, 0.22)	0.01 (-0.30, 0.33)
<i>Newport</i>	-0.08 (-0.80, 0.64)	-0.02 (-0.70, 0.66)	0.15 (-0.22, 0.51)	-0.44 (-0.99, 0.10)	0.48 (-0.14, 1.10)
Nicotine Dependence	-0.04 (-0.11, 0.04)	-0.03 (-0.10, 0.04)	0.01 (-0.02, 0.05)	0.02 (-0.04, 0.07)	0.05 (-0.01, 0.11)
Brand Appeal	0.12 (-0.01, 0.26)	0.07 (-0.06, 0.20)	-0.06 (-0.13, 0.01)	-0.09 (-0.20, 0.01)	-0.06 (-0.18, 0.06)

Note. Data are expressed as β (95% confidence intervals). Abbreviations: WTP, Willingness-to-Pay.

¹From five separate intercept only OLS regression models with bootstrapped (n=10,000) CI's predicting respective packaging design price utility outcome

² GWLs included in 3-month intervention arm included Gangrene; Throat Cancer; Neonatal Baby warnings.

. * $p < .05$ ** $p < .01$, *** $p < .001$.