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

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Tobacco Online Policy Seminar
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Disclosures

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• The content is solely the responsibility of the authors and does not represent the official views of the NIH, FDA, or TRDRP
• Data available on reasonable request

No funding from:

• Tobacco industry, advocacy groups, or pharmaceutical industry

No other financial relationships to disclose
Tobacco Control

Original research

Evaluating US smokers’ willingness to pay for different cigarette packaging designs before and after real-world exposure in a randomised trial

Matthew Stone 1, Claudiu Dimofte 2, David Strong 3, 4, Kim Pulvers 5, Noe C Crespo 6, Eric C Leas 3, 4, John P Pierce 3, 4
16,000,000 Diseased Americans resulting from cigarette smoking

$300 Billion in Annual Costs due to medical care are lost productivity

480,000 Deaths Per Year within the United States are attributed to cigarette smoking
WHO’s Framework Convention on Tobacco Control (FCTC)

- 2003 global treaty put forth to combat the rising tobacco epidemic
- Article 11 of this treaty set out to ensure that…

\[\text{...every person be informed of the health consequences, addictive nature and mortal threat posed by tobacco consumption and exposure to tobacco smoke}\]

- Recommended large health warning labels for all products
- Strongly recommended Graphic Health Warnings Labels (GWLs)
- 182 countries ratified FCTC, but not the United States (US)
Cigarette package health warnings: international status report. Canadian Cancer Society. 2018
What’s the Background?

Family Smoking Prevention and Tobacco Control Act

- June 2009 – Enacted by Congress
- Gave the FDA the regulatory authority over all tobacco products
- Including:
  - Manufacturing
  - Distribution
  - Marketing
- Also, required FDA to mandate graphic warning labels
- A GWL rule was proposed in 2011
What’s the **Background**?

**Tobacco Control Act and Graphic Requirement Court Battles**

- **2009** – Industry lawsuit against the Tobacco Control Act
  Deemed the Act as constitutional
  US Supreme Court denied industry appeal
- **2011** – Second Industry lawsuit against graphic labels
  GWLs struck down on first amendment grounds
- **2019** – Public health groups lawsuit filed against FDA
  Ruled to require the warnings
- **2020** – FDA new rule
  Third lawsuit against the Tobacco Control Act
  Effective date October 6\(^{th}\), 2023
Cigarette Packaging Contains Marketing
Removal of Cigarette Pack Marketing
Impact of Graphic Warnings on Price Perceptions

Research paper
Estimating the ‘consumer surplus’ for branded versus standardised tobacco packaging

Philip Gendall 1, Christine Eckert 2, Janet Hoek 3, Tessa Farah 4
Richard Edwards 5
Correspondence to Professor Philip Gendall, Department of Marketing, Lincoln Institute of Business and Technology, University of Canterbury, Private Bag 4800, Christchurch, New Zealand; philip.gendall@orcag.org.nz

Original research
Tool to assess appeal–aversion response to graphic warning labels on cigarette packs among US smokers
Matthew D Stone 1, 2, Claudia V Dimofte 2, David R Strong 1, 2, Adriana Villasenor 1, 2, Kim Pulvers 4, Karen Messer 1, 2, John P Pierce 1, 2
Correspondence to Dr Matthew D Stone, Family Medicine and Public Health, University of California San Diego, La Jolla, California, USA; m3stone@ucsd.edu
Approach

California Smokers in Australia (CASA): A Randomised Controlled Trial

- Examined the effects packaging has on smoking cognitions and behavior
- Obtained license for 8 images used in Australia and selected 3 to rotate on repackaging of US smokers’ own cigarettes
- Adaptive choice-based conjoint task included at baseline and follow-up
- Explored US smokers’ willingness to pay for different cigarette packaging options following initial exposure and 3-month experience of having their cigarettes repackaged with these options
Effect of Packaging on Smoking Perceptions and Behavior: R01-CA190347

**CASA: Randomized Trial Design**

**Run-in Period:**
- Purchase own packs from study
- Weekly SMS assessments of tobacco cognitions and behavior

**Randomization:**
- Own Pack
- Re-packaged to Rotating GWL plain packs \( n = 117 \)
- Re-packaged to a Blank Pack devoid of Industry Imagery \( n = 125 \)
- Own US Pack containing industry imagery \( n = 115 \)

**Month 1:**
- Baseline Visit:
  - Cigarette pack handling task
  - Sociodemographic and tobacco use surveys

**Month 2:**
- 3-Month Intervention Period:
  - Purchase preferred brand cigarettes re-packaged in 2 of the 3 study conditions

**Month 3:**
- Conjoint Trade-off Task:
  - Willingness to pay measure containing 5 packaging designs

**Month 4:**
- V2: Follow-Up Visit

**Adult Daily Smokers**

N=487

N=357
### CASA Sample Characteristics: N=357

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%) or Mean (SD)</th>
<th>Variable</th>
<th>n (%) or Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>39.08 11.90</td>
<td><strong>Cigarettes per Day</strong></td>
<td>11.65 5.92</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td><strong>Primary Brand Smoked</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>162 45.4%</td>
<td>American Spirit</td>
<td>65 18.2%</td>
</tr>
<tr>
<td>Female</td>
<td>195 54.6%</td>
<td>Camel</td>
<td>94 26.3%</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td>Marlboro</td>
<td>148 41.5%</td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
<td>243 68.1%</td>
<td>Newport</td>
<td>15 4.2%</td>
</tr>
<tr>
<td>Other, Non-Hispanic</td>
<td>74 20.7%</td>
<td>Other</td>
<td>35 9.8%</td>
</tr>
<tr>
<td><strong>Brand Loyal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>269 75.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>88 24.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td><strong>Comparative Brand Perceptions</strong></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>41 11.5%</td>
<td>Harshness</td>
<td>2.41 1.29</td>
</tr>
<tr>
<td>Some college</td>
<td>168 47.1%</td>
<td>Healthiness</td>
<td>4.81 1.46</td>
</tr>
<tr>
<td>College degree</td>
<td>148 41.4%</td>
<td>Affordability</td>
<td>4.47 1.60</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td>Nicotine Dependence (FTND)</td>
<td>3.81 2.28</td>
</tr>
<tr>
<td>Less than $24,999</td>
<td>66 18.5%</td>
<td>Health Anxiety</td>
<td>1.13 0.87</td>
</tr>
<tr>
<td>$25,000 to $49,999</td>
<td>77 21.6%</td>
<td>Psychological Distress (K6)</td>
<td>0.98 0.74</td>
</tr>
<tr>
<td>$50,000 to $99,999</td>
<td>73 20.4%</td>
<td>Sensation Seeking (BSSS)</td>
<td>1.88 0.67</td>
</tr>
<tr>
<td>$100,000 or more</td>
<td>44 12.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not asked</td>
<td>97 27.2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Alpha</th>
<th>Omega</th>
<th>Coef H</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-6</td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1-6</td>
</tr>
<tr>
<td>6</td>
<td>.67</td>
<td>.59</td>
<td>.39</td>
<td>0-10</td>
</tr>
<tr>
<td>7</td>
<td>.86</td>
<td>.81</td>
<td>.52</td>
<td>0-4</td>
</tr>
<tr>
<td>6</td>
<td>.86</td>
<td>.71</td>
<td>.57</td>
<td>0-4</td>
</tr>
<tr>
<td>4</td>
<td>.80</td>
<td>.77</td>
<td>.59</td>
<td>0-3</td>
</tr>
</tbody>
</table>
Approach: **A Willingness to Pay Purchase Task**

Adaptive Choice-Based Conjoint Analysis

A discrete-choice task determined the implicit valuations attributed to various cigarette pack attributes and their corresponding levels.

Identifies how important an attribute is when deciding to purchase a product and partitions off the utility of each attribute level.

An Adaptive Fractional Factorial Design

- “Build Your Own” (BYO) product questionnaire
- A series of products sets which vary 1 to 2 attributes were presented alongside varied cigarette pack prices
- Product choices were made until clear preferences were identified

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pack Design</td>
<td>Gangrene</td>
</tr>
<tr>
<td></td>
<td>Teeth damage</td>
</tr>
<tr>
<td></td>
<td>Blindness</td>
</tr>
<tr>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td></td>
<td>Current US</td>
</tr>
<tr>
<td>Tobacco Origin</td>
<td>Domestic</td>
</tr>
<tr>
<td></td>
<td>Imported</td>
</tr>
<tr>
<td>Quitline Number</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
</tr>
<tr>
<td>Price</td>
<td>±33% of pack $</td>
</tr>
</tbody>
</table>
### Table 2. Conjoint Test Design Report for 1000 Simulated Respondents Answering the ACBC Questions Randomly

<table>
<thead>
<tr>
<th>Bot ID</th>
<th>Packaging</th>
<th>Quitline</th>
<th>Tobacco origin</th>
<th>Price</th>
<th>D-Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US</td>
<td>Blank</td>
<td>Blindness</td>
<td>Teeth</td>
<td>Gangrene</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>2</td>
<td>3</td>
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<tr>
<td>20</td>
<td>3</td>
<td>3</td>
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<td>3</td>
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<tr>
<td>...</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1000</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Conjoint Analysis: A Willingness to Pay Purchase Task

Please remind us what brand of cigarettes you usually smoke.

(please select the main brand out of the choices below and ignore the sub-brands; for example, if you smoke Marlboro Lights please select Marlboro as your brand)

- American Spirit
- Camel
- Marlboro
- Newport
- Other

What is the average price you pay for a pack of cigarettes (including tax)?

(please insert numbers only, with decimals if needed: for example 7.95)

8.49
Conjoint Analysis: A Willingness to Pay Purchase Task

In this task, please create your own cigarette pack.

To start, select one option from each feature to create the pack (it will be displayed on the right side of the screen).

Feel free to change the options until you are satisfied with the final product (i.e., you have created your preferred pack).

When you are done, please click the arrow to continue.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Select One Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>☐ Marketing branded pack</td>
</tr>
<tr>
<td></td>
<td>☐ Plain pack (generic color, no graphic image)</td>
</tr>
<tr>
<td></td>
<td>☐ Pack featuring slightly graphic image (blindness danger)</td>
</tr>
<tr>
<td></td>
<td>☐ Pack featuring moderately graphic image (teeth damage danger)</td>
</tr>
<tr>
<td></td>
<td>☐ Pack featuring highly graphic image (foot gangrene danger)</td>
</tr>
<tr>
<td>Toll free quitline phone number</td>
<td>☐ No toll free quitline phone number listed</td>
</tr>
<tr>
<td></td>
<td>☐ Toll free quitline phone number listed</td>
</tr>
<tr>
<td>Tobacco Source</td>
<td>☐ Domestic tobacco</td>
</tr>
<tr>
<td></td>
<td>☐ Imported tobacco</td>
</tr>
</tbody>
</table>
# Conjoint Analysis: A Willingness to Pay Purchase Task

<table>
<thead>
<tr>
<th>Design</th>
<th>Marketing branded pack</th>
<th>Blank pack</th>
<th>Graphic image pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitline number</td>
<td>Toll free Quitline listed</td>
<td>Toll free Quitline listed</td>
<td>No Quitline listed</td>
</tr>
<tr>
<td>Tobacco origin</td>
<td>Imported tobacco</td>
<td>Domestic tobacco</td>
<td>Imported tobacco</td>
</tr>
<tr>
<td>Price</td>
<td>$8.49</td>
<td>$11.38</td>
<td>$7.65</td>
</tr>
</tbody>
</table>

- ☐ Would possibly buy
- ☑ Would not buy
- ☐ Would possibly buy
- ☑ Would not buy
- ☐ Would possibly buy
- ☑ Would not buy

---

**Question 1 of 9**
Conjoint Analysis: A Willingness to Pay Purchase Task

<table>
<thead>
<tr>
<th>Design</th>
<th>Graphic image pack</th>
<th>Marketing branded pack</th>
<th>Blank pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitline number</td>
<td>Toll free Quitline listed</td>
<td>Toll free Quitline listed</td>
<td>No Quitline listed</td>
</tr>
<tr>
<td>Tobacco origin</td>
<td>Domestic tobacco</td>
<td>Domestic tobacco</td>
<td>Imported tobacco</td>
</tr>
<tr>
<td>Price</td>
<td>$11.44</td>
<td>$12.05</td>
<td>$8.78</td>
</tr>
</tbody>
</table>

- Would possibly buy
- Would not buy

Question 2 of 9
Conjoint Analysis: A Willingness to Pay Purchase Task

<table>
<thead>
<tr>
<th>Design</th>
<th>Graphic image pack</th>
<th>Graphic image pack</th>
<th>Graphic image pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitline number</td>
<td>No Quitline listed</td>
<td>No Quitline listed</td>
<td>Toll free Quitline listed</td>
</tr>
<tr>
<td>Tobacco origin</td>
<td>Imported tobacco</td>
<td>Imported tobacco</td>
<td>Domestic tobacco</td>
</tr>
<tr>
<td>Price</td>
<td>$11.83</td>
<td>$7.47</td>
<td>$6.84</td>
</tr>
</tbody>
</table>

☐ Would possibly buy  ☑ Would not buy
☒ Would not buy  ☐ Would not buy

☒ Would possibly buy  ☑ Would not buy
Conjoint Analysis: A Willingness to Pay Purchase Task

Question 1 of up to 9

<table>
<thead>
<tr>
<th>Design</th>
<th>Graphic image pack</th>
<th>Blank Pack</th>
<th>Graphic image pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitline number</td>
<td>No Quitline listed</td>
<td>No Quitline listed</td>
<td>No Quitline listed</td>
</tr>
<tr>
<td>Tobacco origin</td>
<td>Domestic tobacco</td>
<td>Domestic tobacco</td>
<td>Domestic tobacco</td>
</tr>
<tr>
<td>Price</td>
<td>$7.47</td>
<td>$8.78</td>
<td>$7.65</td>
</tr>
<tr>
<td>Select one</td>
<td>□</td>
<td>✓</td>
<td>□</td>
</tr>
</tbody>
</table>

Design
Quitline number
Tobacco origin
Price
Select one
Figure 1. Change in Willingness to Pay Assessment after 3-month Exposure to Differing Packaging Design Options

Study Design

Run-in Period:
- Purchase own packs from study

Randomization

Month 1
- Own Pack: N = 287

2
- Re-packaged to Rotating GWL plain packs: n = 95
- Re-packaged to a Blank Pack devoid of Industry Imagery: n = 97
- Own US Pack containing industry imagery: n = 95

3

4

V2: Follow-Up Visit
- N = 287

V1: Baseline Visit
- N = 287

3-Month Intervention Period:
- Purchase preferred brand cigarettes re-packaged in 2 of the 3 study conditions

Repeated Conjoint Trade-off Task:
Willingness to pay measure containing 5 packaging designs

Adult Daily Smokers

Adult Daily Smokers

Figure 1. Change in Willingness to Pay Assessment after 3-month Exposure to Differing Packaging Design Options

Study Design

Run-in Period:
- Purchase own packs from study

Randomization

Month 1
- Own Pack: N = 287

2
- Re-packaged to Rotating GWL plain packs: n = 95
- Re-packaged to a Blank Pack devoid of Industry Imagery: n = 97
- Own US Pack containing industry imagery: n = 95

3

4

V2: Follow-Up Visit
- N = 287

V1: Baseline Visit
- N = 287

3-Month Intervention Period:
- Purchase preferred brand cigarettes re-packaged in 2 of the 3 study conditions

Repeated Conjoint Trade-off Task:
Willingness to pay measure containing 5 packaging designs

Adult Daily Smokers

Adult Daily Smokers

Figure 1. Change in Willingness to Pay Assessment after 3-month Exposure to Differing Packaging Design Options

Study Design

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- Purchase own packs from study

Randomization

Month 1
- Own Pack: N = 287

2
- Re-packaged to Rotating GWL plain packs: n = 95
- Re-packaged to a Blank Pack devoid of Industry Imagery: n = 97
- Own US Pack containing industry imagery: n = 95

3

4

V2: Follow-Up Visit
- N = 287

V1: Baseline Visit
- N = 287

3-Month Intervention Period:
- Purchase preferred brand cigarettes re-packaged in 2 of the 3 study conditions

Repeated Conjoint Trade-off Task:
Willingness to pay measure containing 5 packaging designs

Adult Daily Smokers

Adult Daily Smokers
Any questions?
Conjoint Analysis

Attribute Level Utility and Willingness to Pay

Multinomial logit hierarchical Bayesian estimation determined the utility of product attribute levels using 40,000 iterative models. This allows the implicit value (utilities) of the individual product characteristics to be determined:

- These utilities represent a relative weighted preference for each attribute level.
- Dollar per utility were derived and willingness to pay valuations calculated.
- Attribute importance scores then derived.
## Change in Relative Importance of Pack Attributes

### Table 3.1 Change in Cigarette Pack Attribute Importance after 3-month Packaging Invention (N=287)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Relative Importance&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Difference in importance&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (95% CI)</td>
<td>Follow-up (95% CI)</td>
</tr>
<tr>
<td>Price</td>
<td>69.40 (68.49, 70.31)</td>
<td>70.96 (69.98, 71.95)</td>
</tr>
<tr>
<td>Packaging</td>
<td>24.07 (23.21, 24.92)</td>
<td>22.03 (21.10, 22.97)</td>
</tr>
<tr>
<td>Tobacco origin</td>
<td>3.78 (3.62, 3.95)</td>
<td>4.33 (4.16, 4.50)</td>
</tr>
<tr>
<td>Quitline</td>
<td>2.75 (2.63, 2.87)</td>
<td>2.68 (2.59, 2.76)</td>
</tr>
</tbody>
</table>

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

1. Attributes represent the different product characteristics of the cigarette pack.
2. Importance scores reflect the relative importance of each attribute in making the choice to purchase.
3. From bootstrapped dependent samples t-tests (n=10,000).

* p < .05 ** p < .01, *** p < .001.
Table 3.2 Change in Price Utilities of Cigarette Pack Designs by Intervention Arm among Daily Smokers

<table>
<thead>
<tr>
<th>Packaging attribute level</th>
<th>US Branded Pack Arm</th>
<th>Blank Pack Arm</th>
<th>GWL Pack Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline price utility¹</td>
<td>Change² in price utility at V2</td>
<td>Baseline price utility¹</td>
</tr>
<tr>
<td></td>
<td>(N = 95)</td>
<td>Δ (95%CI)</td>
<td>(N = 95)</td>
</tr>
<tr>
<td>Current US</td>
<td>$1.92</td>
<td>-$0.02 (-0.28, 0.24)</td>
<td>$2.22</td>
</tr>
<tr>
<td>Blank</td>
<td>$1.51</td>
<td>$0.13 (-0.11, 0.37)</td>
<td>$1.81</td>
</tr>
<tr>
<td>Blindness</td>
<td>-$0.80</td>
<td>$0.11 (-0.04, 0.25)</td>
<td>-$0.74</td>
</tr>
<tr>
<td>Teeth damage</td>
<td>-$1.03</td>
<td>-$0.26 (-0.46, -0.07)*</td>
<td>-$1.24</td>
</tr>
<tr>
<td>Gangrene</td>
<td>-$1.60</td>
<td>$0.05 (-0.18, 0.28)</td>
<td>-$2.06</td>
</tr>
</tbody>
</table>

Note. N=287. Abbreviations: V1, Visit 1; V2, Visit 2. Data expressed as Mean or Mean Δ (95% confidence intervals).

¹ 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.

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

*p < .05 ** p < .01, *** p < .001
### Adjusted Change in Willingness to Pay by Study Arm

**Outcome:** Cigarette Pack Price Utility (i.e., Willingness-to-pay)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Current US</th>
<th>Blank</th>
<th>Blindness</th>
<th>Teeth Damage</th>
<th>Gangrene</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-month intervention arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US pack</td>
<td>Ref</td>
<td>-0.34 (-0.72, 0.04)</td>
<td>-0.25 (-0.62, 0.11)</td>
<td>-0.07 (-0.27, 0.12)</td>
<td>0.20 (-0.09, 0.49)</td>
</tr>
<tr>
<td>Blank pack</td>
<td>Ref</td>
<td>-0.38 (-0.76, -0.00)*</td>
<td>-0.27 (-0.64, 0.10)</td>
<td>0.01 (-0.19, 0.20)</td>
<td>0.18 (-0.12, 0.47)</td>
</tr>
<tr>
<td>GWL pack</td>
<td>Ref</td>
<td>-0.38 (-0.76, -0.00)*</td>
<td>-0.27 (-0.64, 0.10)</td>
<td>0.01 (-0.19, 0.20)</td>
<td>0.18 (-0.12, 0.47)</td>
</tr>
<tr>
<td><strong>Baseline WTP</strong></td>
<td></td>
<td>0.58 (0.46, 0.70)*****</td>
<td>0.63 (0.51, 0.76)*****</td>
<td>0.38 (0.25, 0.51)*****</td>
<td>0.56 (0.44, 0.69)*****</td>
</tr>
</tbody>
</table>

*Note.* From five separate baseline adjusted OLS regressions. Covariates included age, sex, race/ethnicity, education, cigarette brand preference, nicotine dependence, and brand appeal.

**Figure 2.** Post-intervention estimated marginal means.
What’s the price aversion initially?

Note. Estimates from within the GWL arm of the trial.
What’s the price aversion after 3-months exposure?

Note. Estimates from within the GWL arm of the trial
Discussion

Pre-intervention

- Most important factor was Price (70%) then pack design (24%)
- US packs generated considerable appeal valuations, which was only slightly higher (~$0.40) than blank packs with no marketing

Post-intervention

- Price importance remained unchanged, but the importance packaging was minimally reduced (2%)
- Participants assigned to the US pack arm experienced no significant change in willingness to pay
- Participants assigned Blank pack arm remained unchanged in their willingness to pay for all but one pack design (gangrene)
Discussion

Pre-intervention
• Overall, the impact GWLs had on product price perceptions was approximately equivalent to a substantial $3.00 excise tax

Post-intervention
• Participants assigned to the GWL pack arm experienced a weakening in the discount needed to willingly purchase the ‘Gangrene’ pack suggesting wear-out from repeated exposure
• No change in the discount needed to willingly purchase the GWL packs not in the intervention (‘Blindness’ and ‘Teeth Damage’)  
• Suggests that desensitization effects may be specific to repeated exposure which may be overcome by image refreshment
Limitations and **Strengths**

**Limitations**
- Price estimates tend to overstate the amount that consumers would pay
- RCT study groups were not stratified by conjoint estimates and these groups were not balanced on this measure
- Unable to estimate the impact for non-daily smokers, susceptible non-smokers or smokers ready to quit

**Strengths**
- Anchored choices on preferred brands the pack prices regularly paid
- Exposed participants to conjoint packs by allowing them to handle the designs for several minutes prior to completion of the first price task
- Purchased their cigarettes packaged in one of these designs for 3 month before once again completing the willingness-to-pay assessment.
Conclusion

- US packaging generates appeal and adds to the value of the product
- Graphic packaging engenders price aversion and represents a loss in perceived product value
- Yet this effect begins to wear out after a 3-months exposure to obtaining cigarettes in GWL packs, indicating a need for refreshment of GWL images
- Future studies are needed to determine whether these results translate to hybrid-style packaging proposed by Food and Drug Administration for implementation in the USA
Acknowledgments

Coauthors
David Strong, John Pierce, Eric Leas, Claudiu Dimofte and Noe Crespo

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Jesica Oratowski, Elizabeth Brighton, Joyce Bertaux, Adriana Villasenor, Tingyi Yang, Kim Pulvers, Samantha Hurst, and all the dedicated undergrads

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The Commonwealth of Australia
Awarded a license to the Regents of the University of California to use their cigarette package designs in a randomised trial on the effect of cigarette packaging on smoking perceptions and behavior in the USA
Thank You!

Any questions?
### Adjusted associations with Willingness to Pay

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Current US</th>
<th>Blank</th>
<th>Blindness</th>
<th>Teeth Damage</th>
<th>Gangrene</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-month intervention arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US pack</td>
<td>Ref</td>
<td>-0.34 (-0.72, 0.04)</td>
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<td>-0.07 (-0.27, 0.12)</td>
<td>0.20 (-0.09, 0.49)</td>
</tr>
<tr>
<td>Blank pack</td>
<td>Ref</td>
<td>-0.38 (-0.76, -0.00)**</td>
<td>-0.27 (-0.64, 0.10)</td>
<td>0.01 (-0.19, 0.20)</td>
<td>0.18 (-0.12, 0.47)</td>
</tr>
<tr>
<td>GWL pack²</td>
<td>Baseline WTP</td>
<td>0.58 (0.46, 0.70)**</td>
<td>0.63 (0.51, 0.76)***</td>
<td>0.38 (0.25, 0.51)***</td>
<td>0.56 (0.44, 0.69)***</td>
</tr>
<tr>
<td><strong>Baseline WTP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Covariate Controls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td>0.01 (-0.01, 0.02)</td>
<td>0.01 (-0.01, 0.02)</td>
<td>-0.00 (-0.01, 0.00)</td>
<td>-0.00 (-0.01, 0.01)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Female</td>
<td>-0.08 (-0.41, 0.25)</td>
<td>-0.06 (-0.39, 0.26)</td>
<td>-0.05 (-0.22, 0.12)</td>
<td>0.06 (-0.20, 0.31)</td>
<td>-0.00 (-0.29, 0.29)</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>White, non-Hispanic</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-0.16 (-0.68, 0.36)</td>
<td>0.04 (-0.46, 0.54)</td>
<td>0.02 (-0.24, 0.29)</td>
<td>0.01 (-0.38, 0.41)</td>
<td>0.08 (-0.36, 0.53)</td>
</tr>
<tr>
<td>Other, non-Hispanic</td>
<td>0.22 (-0.17, 0.61)</td>
<td>0.20 (-0.17, 0.58)</td>
<td>-0.17 (-0.37, 0.03)</td>
<td>-0.14 (-0.44, 0.16)</td>
<td>-0.12 (-0.46, 0.22)</td>
</tr>
<tr>
<td>Education</td>
<td>College degree or +</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Some college</td>
<td>-0.06 (-0.39, 0.27)</td>
<td>-0.09 (-0.41, 0.23)</td>
<td>-0.02 (-0.19, 0.15)</td>
<td>0.14 (-0.12, 0.39)</td>
<td>0.00 (-0.28, 0.29)</td>
</tr>
<tr>
<td>High School or less</td>
<td>0.10 (-0.42, 0.62)</td>
<td>-0.10 (-0.61, 0.40)</td>
<td>0.06 (-0.21, 0.32)</td>
<td>0.16 (-0.24, 0.56)</td>
<td>-0.16 (-0.61, 0.29)</td>
</tr>
<tr>
<td>Cigarette Brand</td>
<td>Marlboro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Spirit</td>
<td>0.02 (-0.41, 0.45)</td>
<td>-0.04 (-0.45, 0.38)</td>
<td><strong>-0.30 (-0.52, -0.08)</strong></td>
<td>0.08 (-0.25, 0.41)</td>
<td>0.30 (-0.07, 0.67)</td>
</tr>
<tr>
<td>Camel</td>
<td>-0.09 (-0.47, 0.28)</td>
<td>0.03 (-0.32, 0.38)</td>
<td>0.17 (-0.02, 0.36)</td>
<td>-0.06 (-0.34, 0.22)</td>
<td>0.01 (-0.30, 0.33)</td>
</tr>
<tr>
<td>Newport</td>
<td>-0.08 (-0.80, 0.64)</td>
<td>-0.02 (-0.70, 0.66)</td>
<td>0.15 (-0.22, 0.51)</td>
<td>-0.44 (-0.99, 0.10)</td>
<td>0.48 (-0.14, 1.10)</td>
</tr>
<tr>
<td>Nicotine Dependence</td>
<td>-0.04 (-0.11, 0.04)</td>
<td>-0.03 (-0.10, 0.04)</td>
<td>0.01 (-0.02, 0.05)</td>
<td>0.02 (-0.04, 0.07)</td>
<td>0.05 (-0.01, 0.11)</td>
</tr>
<tr>
<td>Brand Appeal</td>
<td>0.12 (-0.01, 0.26)</td>
<td>0.07 (-0.06, 0.20)</td>
<td>-0.06 (-0.13, 0.01)</td>
<td>-0.09 (-0.20, 0.01)</td>
<td>-0.06 (-0.18, 0.06)</td>
</tr>
</tbody>
</table>
Effect of Packaging on Smoking Perceptions and Behavior: The CASA Randomized Trial

GWL Plain Packs licensed from the Commonwealth of Australia

Blank Packaging
Original Investigation | Substance Use and Addiction

Effect of Graphic Warning Labels on Cigarette Packs on US Smokers' Cognitions and Smoking Behavior After 3 Months
A Randomized Clinical Trial

David R. Strong, PhD; John P. Pierce, PhD; Kim Pulvers, PhD; Matthew D. Stone, MS; Adriana Villaseñor, PhD; Minya Pu, MA; Claudiu V. Dimofte, PhD; Eric C. Leas, PhD; Jessica Oratowski, MPH; Elizabeth Brighton, BS; Samantha Hurst, PhD; Sheila Kealey, MPH; Rui Feng Chen, MS; Karen Messer, PhD
A Change in positive perceptions of recent cigarettes

US pack

GWL pack

Blank pack

B Perceptions of health effects

US pack

GWL pack

Blank pack
Pack Handling Task during Initial Exposure

Eye View Video Coding of Cigarette Pack Handling during Initial Exposure to Graphic Warning Labels

- a. Attention to **Front** of Pack
- b. Attention to **Left Side** of Pack
- c. Attention to **Back** of Pack
Coding Reactivity: Inter-Rater Reliability

**Low Negative**
- Moderately emotional words describing that are negatively valanced followed by statements that overrule the response.
- No visceral reaction or amplified moderately emotional words that are negatively valanced to describe aversion.
- Mild aversion followed by rationalization (e.g., pack design would not modify behavior).

**Neutral**
- No emotional words to describe pack.
- No or little reaction to the pack and/or appear to be unaffected by the pack.
- Text on the pack may be read without saying how it makes them feel.

**Low Positive**
- Moderately emotional words describing that are positively valanced followed by statements that overrule the response.
- No visceral reaction or amplified moderately emotional words that are positively valanced to describe appeal.
- Mild appeal followed by rationalization (e.g., acknowledges the health consequences of smoking).

**Packaging Agreement**
- ICC
  - Current US: 0.95
  - Blank: 0.93
  - Throat Cancer: 0.90
  - Neonatal Baby: 0.93
  - Foot Gangrene: 0.89

**Coding Reactivity: Inter-Rater Reliability**

- **High (−3)**
- **Medium (−2)**
- **Low (−1)**
- **Neutral (0)**
- **Low (+1)**
- **Medium (+2)**
- **High (+3)**

- **Negative**
- **Reactivity**
- **Positive**
Positive–Negative Reactivity and Speech Polarity

Current US
Blank
Throat Cancer
Neonatal Baby
Foot Gangrene

Categorical Reactivity Score

High positive
Medium positive
Low positive
Neutral
Low negative
Medium negative
High negative

“These feel very familiar, very attractive… The descriptive words on the front, like smooth, rich, mellow, it’s just attractive and very comfortable and familiar to me.”

“Yeah. I mean, it’s definitely something that I’d rather quit before I get to that point. Yeah, it’s a pretty unpleasant picture… I think that would be very sad. I feel badly. …I smoked when I was pregnant, and my daughter was fine, I think. And hopefully I didn’t cause any damage so maybe I’m feeling a little worried that I’m guilty of hurting her.”

“Nothing really on there, there’s the warning label… Very plain.”

“Yeah. I mean, it’s definitely something that I’d rather quit before I get to that point. Yeah, it’s a pretty unpleasant picture… I think that would be very sad. I feel badly. …I smoked when I was pregnant, and my daughter was fine, I think. And hopefully I didn’t cause any damage so maybe I’m feeling a little worried that I’m guilty of hurting her.”

Natural Language Processing: Rate of Emotive Words

Figure 1. Average Rate of Emotive Words Spoken During Pack Exposure Period (n=324). A semantic analysis of transcribed speech that was text mined for emotive utterances using an emotion word lexicon and computing the rate of emotive words expressed per sentence between 0% (no words were emotive) and 100% (all words were emotive).
Association between \textbf{Reactivity} and \textbf{Price Utility} at V1

\begin{align*}
\text{Association between Willingness to Pay for and Reactivity to GWLs} \\
\text{Association between Willingness to Pay for and Reactivity to US Packaging}
\end{align*}

\begin{align*}
\text{Estimator} & \quad \text{Loess} & \quad \text{LM} \\
\text{Estimator} & \quad \text{Loess} & \quad \text{LM}
\end{align*}

\begin{align*}
r(255) &= 0.24 \ (95\% \text{CI}=0.12, 0.35), \ p<.001 \\
r(255) &= 0.12 \ (95\% \text{CI}=-0.01, 0.24), \ p=.063
\end{align*}