

Estimating the 'consumer surplus' for branded versus standardised tobacco packaging

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ABSTRACT

Background Tobacco companies question whether standardised (or 'plain') packaging will change smokers' behaviour. We addressed this question by estimating how standardised packaging compared to a proven tobacco control intervention, price increases through excise taxes, thus providing a quantitative measure of standardised packaging's likely effect.

Methods We conducted an online study of 311 New Zealand smokers aged 18 years and above that comprised a willingness-to-pay task comparing a branded and a standardised pack at four different price levels, and a choice experiment. The latter used an alternative-specific design, where the alternatives were a branded pack or a standardised pack, with warning theme and price varied for each pack.

Results Respondents had higher purchase likelihoods for the branded pack (with a 30% warning) than the standardised pack (with a 75% warning) at each price level tested, and, on average, were willing to pay approximately 5% more for a branded pack. The choice experiment produced a very similar estimate of 'consumer surplus' for a branded pack. However, the size of the 'consumer surplus' varied between warning themes and by respondents' demographic characteristics.

Conclusions These two experiments suggest standardised packaging and larger warning labels could have a similar overall effect on adult New Zealand smokers as a 5% tobacco price increase. The findings provide further evidence for the efficacy of standardised packaging, which focuses primarily on reducing youth initiation, and suggest this measure will also bring notable benefits to adult smokers.

INTRODUCTION

Australia has successfully introduced standardised (or 'plain') packaging of tobacco products, and the UK and France have passed legislation and will introduce standardised packaging in 2016. Furthermore, legislation to mandate plain packaging is awaiting its second reading in the New Zealand Parliament. Standardised packaging responds to tobacco companies' considerable investment in brand development, refinement and protection and to evidence that brands make tobacco products more appealing.^{1–3} Brand appeals often relate not to functional product attributes, but to symbolic properties that consumers use to create and communicate social identities.^{4–6} Many products, including tobacco, are largely homogenous, thus brand imagery creates associations that become differentiating attributes,^{1 2 6} and enables producers to sustain higher margins.^{7 8}

Although price increases are a powerful policy lever and reduce overall tobacco consumption, tobacco's addictive nature means even excise tax increases fail to stimulate quitting among many smokers.^{9 10} Furthermore, smokers can mitigate the impact of tax increases by smoking fewer cigarettes or trading down to less expensive brands, thus modest, regular price increases may have reduced impact over time.¹¹ Excise tax increases also enable tobacco companies to manipulate prices; for example, by increasing the price of premium brands beyond the tax increase to enhance profits and subsidise budget brands.^{9 12} Evidence that smokers adapt to predictable price increases, while the tobacco industry uses these to enhance profitability, suggests multifaceted tobacco control strategies, including standardised packaging, are required to reduce smoking prevalence.

Standardised packaging has multiple objectives but aims primarily to reduce the appeal of tobacco products to young adults, the group most susceptible to branding and at greatest risk of smoking experimentation.^{13–15} Replacing brand livery with larger and more impactful pictorial warning labels also aims to reduce misperceptions about the risks of smoking^{16 17} and ensure warning information is visually salient.^{18 19} Evaluations from Australia show this policy has reduced the appeal of cigarette packages among adolescents, led smokers to report reduced satisfaction with their pack, increased thoughts of quitting among adults, and stimulated quit attempts.^{20–24} Standardised packaging involves two separate actions: the removal of all brand imagery, and a larger pictorial warning label. Of the few studies to examine the relative contribution of brand level and warning size, Wakefield *et al*²⁵ found that brand removal had a stronger effect than warning size on brand appeal and purchase intention, and recommended adoption of both actions.

Because standardised packaging no longer offers smokers with the reassurance familiar branding provides,^{6 14 26} their willingness-to-pay (WTP) for products packaged in this way may also change. To investigate how standardised packaging affects perceived value, Thrasher *et al*²⁷ used experimental auctions in which participants made actual purchases of cigarettes they 'won' in the auction. These immediate monetary consequences simulate purchase scenarios and arguably reveal true WTP, as the method (the Becker-DeGroot-Marschak method) is designed to remove any incentive to underbid. Using this approach, Thrasher *et al*²⁷ found the lowest level of demand was associated with a 'plain', standardised pack featuring a



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prominent pictorial warning. Further analysis showed pictorial warnings were more effective at encouraging younger smokers to reduce their WTP for cigarettes, whereas 'plain' standardised packaging proved most effective at reducing WTP among less educated smokers.²⁸

However, despite the realism offered by experimental auctions, they are complex to conduct.²⁹ Furthermore, Thrasher *et al*'s US study stimuli did not progressively reduce the branding level tested, making it difficult to isolate the separate effects on perceived value of different pack elements. In addition, the 'plain' standardised pack font did not use the Australian format. Our New Zealand study addressed the same question as Thrasher *et al* and used two alternative approaches—a choice experiment and a WTP task—to estimate the 'consumer surplus' associated with a branded pack of cigarettes compared to the equivalent standardised pack. By 'consumer surplus' we mean the additional amount smokers would be willing to pay for a branded pack rather than a standardised, or plain, pack.³⁰

METHODS

Procedure

We conducted a choice experiment to estimate how different branding levels and warning themes affected cigarette pack selection; we also tested smokers' WTP for branded and standardised packaged cigarettes. Ethics approval was provided by a delegated authority of the University of Otago's Human Ethics Committee.

Sample

We sourced a sample of 311 adult smokers aged 18 years and above from Research Now Ltd, a commercial New Zealand online panel provider, between 25 and 28 November 2014. Research Now has the largest research-only online panel in New Zealand, with over 60 000 active members (defined as those who have either updated their panel profile or responded to a survey invitation in the last 12 months); survey participants receive small cash rewards for completing surveys. Though the Valued Opinions panel is broadly representative of the New Zealand population, males are under-represented and females are over-represented in the panel. However, quotas were applied to the sample to match its composition to the age and gender profile of the New Zealand smoker population.

Panel members who responded to the survey invitation answered a screening question about their smoking status; those who were not self-defined daily or occasional smokers were excluded from the study, as were former and non-smokers. In total, 596 survey attempts were made; 192 were by non-smokers and 87 by respondents for quotas that were full. This gave 317 completed surveys, 6 of which were removed from the database during data cleaning. The questionnaire comprised 28 items and on average took between 5 and 10 min to complete.

Study design: choice experiment

The stimuli used were the front of a branded pack featuring a 30% pictorial warning label (the status quo in New Zealand at the time) and a standardised pack with a 75% warning label. The latter stimulus reflects the Australian pack design and recognises Wakefield *et al*'s²⁵ recommendations. Both packs had the same brand name, 'KOOL'; this brand is not available in New Zealand and was used to avoid potential loyalty effects that a New Zealand brand may have created.

The packs featured two different warnings. A 'social' warning showed a mouth with teeth replaced by burning cigarettes and the headline 'smoking stinks'. A 'health' warning featured an

image of a cancerous tongue with the words 'smoking causes mouth cancer'. Four price levels were used with prices starting at NZ\$16.00 (approximately US\$12.00), the average price of a pack of cigarettes in New Zealand in 2014, and increased by 30 cent increments to \$16.90 (all currency in NZ\$ unless otherwise stated). We drew on Thrasher *et al*²⁷ to develop this price range of just over 5% which, according to their findings, appeared the likely maximum premium New Zealand smokers would be prepared to pay for a branded pack. Table 1 summarises the attributes and levels tested.

Experimental design

We used a $2^2 \times 4^2$ Alternative-Specific design, where the alternatives were a branded pack or a standardised pack, with warning theme and price varied for each pack. This design requires 16 pairs, or choice sets, which were divided into two blocks of eight pairs each (to allow us to reduce the burden on respondents by showing them only one block of choice sets). We added two common choice sets to each block, to ensure that all respondents were exposed to at least two identical stimuli. One set presented the two options at their lowest price and featured what we expected to be the less aversive warning (the social theme) while the second set featured the highest price and most aversive warning (the health theme). The overall design thus comprised two blocks of 10 choice sets.

Each respondent viewed one block of 10 choice sets presented randomly and, for each set, was asked: *If these were the cigarettes you had to choose from, which pack would you be most likely to buy?* Respondents could choose either the branded pack or standardised pack, or neither option.

Study design: WTP experiment

The second survey component tested smokers' WTP for either branded or standardised packaged cigarettes at different prices: \$14.40 (10% less than the average price, and similar to a budget brand), \$16.00 (average price), \$17.60 (10% more than average price and similar to a premium brand) and \$19.20 (20% more than average price). This price range was larger than that tested in the choice experiment (up to 20% above the average price) and included a price lower than the current average price for a pack of cigarettes. The wider range allowed us to examine the effect of much larger price differences, and the difference between 'budget' and 'premium' price levels.

Respondents saw either a branded pack with a 30% social warning label or a standardised pack with a 75% health warning label. They viewed each pack four times at a different price level, starting at \$14.40 and progressing to \$19.20, and used an 11-point probability scale similar to the Juster Scale to estimate

Table 1 Choice attributes and levels

Attributes	Levels
Branding	Full—30% warning Plain pack—75% warning
Warning theme	Health Social
Price	Current (\$16.00) +2% (\$16.30) +4% (\$16.60) +6% (\$16.90)
Brand name KOOL	

their purchase likelihood, or probability, at the four price points.³¹

Figure 1 illustrates the choice task respondents completed and shows the two packs evaluated in the WTP experiment.

Analyses

To test differences in the WTP for branded and standardised packs, we used independent sample t tests of the differences between the mean scores, and linear regression analyses, which were undertaken using SPSS V22.

For the choice experiment, we used multinomial logit regression analysis and Scale-Adjusted Latent Class Models (SALCMs), the latter to identify a statistically defensible number of preference and scale classes from the choice data. SALCMs recognise that respondents may differ in their preferences for the options presented as well as in their scales (or choice consistency), or both. By removing the scale factor confound in multinomial choice models, SALCMs avoid biases that occur as a result of choice variability; the resulting unbiased estimates are also statistically more efficient. SALCMs produce probabilistic segments with fuzzy boundaries and avoid the arbitrary case allocation that occurs at the margins of traditional segments.

We used the syntax module of Latent Gold V5.0 software to undertake these analyses;³² this software allows preference parameters to differ for discrete, but unobserved preference classes of respondents, while also allowing the underlying variability of random errors to differ between several discrete scale classes. SALCMs also allow membership of latent preference and scale classes to be predicted as functions of demographic and other covariates following a multinomial logit model. We followed Bliemer and Rose's approach to estimating CIs.³³ The analyses presented use preferred pack data (ie, analyse the options respondents indicated they would be *most likely* to buy).

RESULTS

Sample characteristics

In total, 311 self-defined daily or occasional smokers participated in the study; online supplementary table S2 contains

details of the sample characteristics, which generally reflect the demographics of the New Zealand smoking population. However, Māori and Pacific peoples are under-represented and our respondents tended to be better educated and more affluent than the New Zealand smoker population in general.

WTP experiment

Although respondents completed the choice task before the WTP experiment, we present the latter findings first to create a context for the more sophisticated choice experiment. We estimated the mean likelihood (out of 10) that respondents would buy a fully branded or standardised pack at four prices between \$14.40 and \$19.20; table 2 contains these results. Purchase likelihood decreased as price increased and, at each price level, the mean likelihood (probability) of buying a branded pack was greater than for buying a standardised pack. However, as price increased, branding mattered less, and differences between mean purchase probabilities are significant only at the two lower prices (two-tailed test, critical p values <0.005).

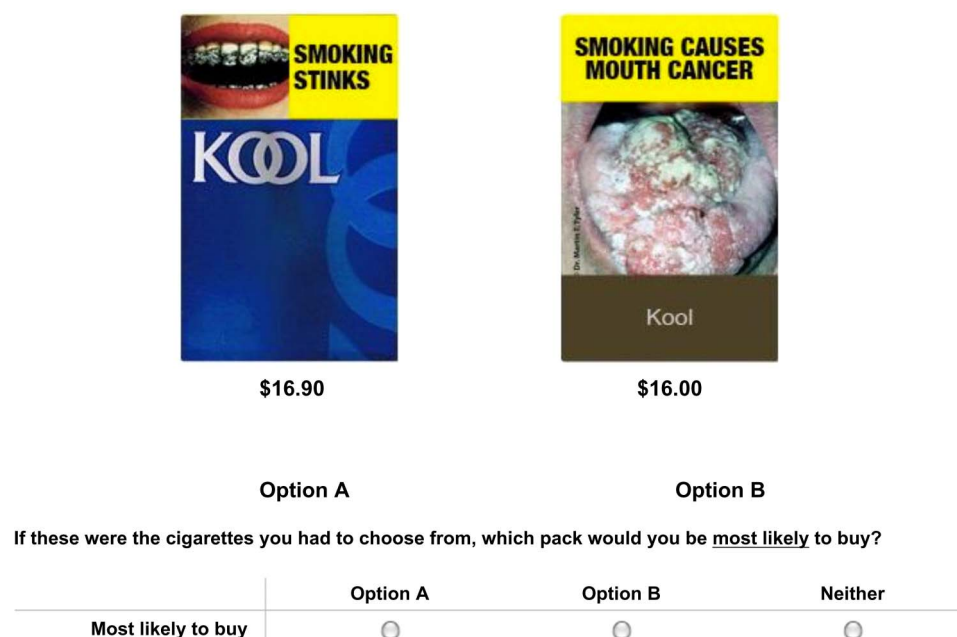
Estimating 'consumer surplus'

To calculate the average 'consumer surplus' associated with a fully branded pack, we estimated a linear regression equation with purchase probability as the dependent variable, and price level (\$14.40, \$16.00, \$17.60, and \$19.20) and a dummy variable for pack type (branded=1 or standardised=0) as the independent variables. (An interaction term for price * pack type was initially included, but the estimated coefficient was not statistically significant (p=0.133) and the term was omitted from the equation.)

The estimated equation was:

$$\text{Purchase probability} = 20.286 - 0.914\text{Price level} + 0.747\text{Pack type}$$

All three regression coefficients were significant at $p \leq 0.0001$, and the adjusted R^2 for the equation was 0.25.



Option A

Option B

If these were the cigarettes you had to choose from, which pack would you be most likely to buy?

Most likely to buy

Option A

Option B

Neither

Figure 1 The choice task respondents completed and shows the two packs evaluated in the WTP experiment. WTP, willingness-to-pay.

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Table 2 Mean likelihood of buying a branded or standardised pack

Likelihood of buying (0–10)	NZ\$14.40	NZ\$16.00	NZ\$17.60	NZ\$19.20
Branded pack (n=151)*				
Mean	7.95	6.59	4.52	3.06
95% CI	(7.56 to 8.35)	(6.16 to 7.02)	(4.06 to 4.98)	(2.58 to 3.55)
Standardised pack (n=153)*				
Mean	7.08	5.42	3.88	2.79
95% CI	(6.61 to 7.55)	(4.94 to 5.91)	(3.38 to 4.38)	(2.29 to 3.30)
Difference between Branded and standardised pack	0.9	1.2	0.6	0.3
Significance of difference	0.005	<0.001	0.061	0.464

*Subsamples add to 304 rather than 311 because of missing data.

From this equation, the estimated ‘consumer surplus’ is $0.747/0.914 = \$0.82$ (95% CI \$0.45 to \$1.18);³³ smokers were thus willing to pay NZ \$0.82, approximately 5%, more for the branded pack than for the standardised pack at the mean price level (\$0.82/\$16.80).

Choice experiment

We analysed the choice data by assuming that the unobserved utility of a cigarette pack alternative in a given set consists of a deterministic utility and a stochastic, Gumbel-distributed, error term. The deterministic part of the utility was additive in the different product attributes (ie, branding level, warning theme and price), a baseline utility of choosing any of the packs, and the interaction of branding level and warning theme. The latter accounted for the fact that warnings may have a stronger impact on standardised (75% pack surface) than on branded packs (30% of pack surface). The utility of choosing neither pack was assumed to be the sum of a baseline utility of choosing neither of the packs (set to minus the baseline utility of choosing either pack for identification purposes) and a Gumbel distributed error term.

The best statistical model had three preference classes and one scale class, the latter indicating consistency among respondents’ choice patterns. The Wald tests for each attribute, the interaction of branding level and warning theme, and the baseline utility of choosing either alternative, were all significant at

$p < 0.01$; all elements of the utility function thus significantly improved the model fit.

We developed parameter estimates for the whole sample using an aggregate multinomial logit model before developing estimates for each latent class model preference segment. Table 3 presents these results. The coefficients in the table are the part-worth utilities of the pack attributes.

The latent class model approach captured differences between the three preference segments identified. All three segments preferred the fully branded pack to the standardised pack. Segment one members (the largest segment and 43% of the sample) showed a strong preference for the branded pack; the other two segments had a weaker preference for the branded pack. Segment one members preferred the health warning to the social warning. The second segment (38% of the sample) had the lowest preference for the branded pack and preferred the social warning. This segment also had the largest disutility of not buying any pack (ie, they had the largest coefficient for ‘No Choice’); that is, this segment was most willing to accept any pack, whether branded or plain. The final segment’s members (19% of the sample) also preferred the branded pack and the social warning (see table 3).

Estimating ‘consumer surplus’

The parameter estimates of the multinomial logit and latent class models can be converted into WTP for the different non-price

Table 3 Multinomial logit and latent class parameter estimates

Attributes*	Whole sample		Segment 1 43%		Segment 2 38%		Segment 3 19%	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Branding level								
Fully branded	0.667	0.025	2.038	0.170	0.274	0.043	0.529	0.084
Standardised pack	−0.667	0.025	−2.038	0.170	−0.274	0.043	−0.529	0.084
Warning theme								
Social	0.238	0.034	−1.082	0.218	0.598	0.069	0.632	0.089
Health	−0.238	0.034	1.082	0.218	−0.598	0.069	−0.632	0.089
Interactions								
Branded and health or standardised and social	0.151	0.029	−0.071	0.014	0.256	0.043	−0.040	0.087
Branded and social or standardised and health	−0.151	0.029	0.071	0.014	−0.256	0.043	0.040	0.087
Price	−1.681	0.105	−2.340	0.372	−2.371	0.239	−0.739	0.227
No choice								
Alternative	14.464	0.870	20.772	2.916	21.612	2.034	5.542	1.861
No choice	−14.464	0.870	−20.772	2.916	−21.612	2.034	−5.542	1.861

*All coefficients significant at $p \leq 0.01$.

Table 4 Estimated 'consumer surplus': choice experiment

Attribute	'Consumer Surplus' estimates (cents, NZ currency)			
	Whole sample estimate (95% CI)	Segment 1 estimate (95% CI)	Segment 2 estimate (95% CI)	Segment 3 estimate (95% CI)
Branded pack versus standardised pack (averaged over warning theme)	79 (74 to 84)	174 (145 to 203)	23 (20 to 27)	143 (96 to 191)
Social warning versus health warning (averaged over warning theme)	28 (24 to 32)	−93 (−120 to (−64))	50 (44 to 57)	171 (113 to 229)
Branded pack with social warning versus standardised pack with health warning	108 (83 to 132)	82 (38 to 126)	74 (54 to 93)	314 (125 to 504)

attributes. For example, the WTP for a branded versus a standardised pack equals the ratio of the difference between the two respective parameter estimates of the utility function and the negative of the price parameter. Thus, for the multinomial logit model, average WTP=(0.667-(-0.667)/1.681)=NZ\$0.794, or 79 cents. Table 4 contains the 'consumer surplus' estimates for the whole sample and the three preference segments.

At the average price across the range of \$16.00 to \$16.90, 79 cents represents (\$0.79/\$16.45)=4.8%; thus, on average, smokers were willing to pay approximately 5% more for a branded pack than for a standardised pack. However, the branded pack with the 'smoking stinks' warning compared to the standardised pack with the cancerous tongue warning had an estimated 'consumer surplus' of \$1.08, approximately 7% of the average price range tested. Furthermore, as table 4 also shows, the estimated surplus differs for the three preference segments and the warning concerned.

Characteristics of preference segments

Table 5 outlines demographic and behavioural characteristics of the three preference segments. Respondents' segment memberships are based on the multinomial logit model that (together with the conditional logit model for choice) underlies the latent class model. The multinomial logit model provides two different statistics: First, it provides a test of whether a distinction among the different demographic subgroups is significant in explaining segment membership. In our analysis, three characteristics played a significant, or near-significant, role in differentiating between preference segments: smoking status ($p=0.098$), whether the respondent had made a recent quit attempt ($p=0.025$), and quit intention in the next 6 months ($p=0.091$). Second, it determines whether a particular demographic group is statistically more or less likely to belong to a particular segment (see significance levels shown in table 5).

Segment 1 members (who most strongly preferred the branded pack and preferred the health warning) were more likely than expected to be 55 and older ($p<0.1$) and New Zealand European rather than Māori or Pacific, or Asian ($p<0.05$). Segment 2 members (who preferred the social warning) were significantly more likely to be daily smokers than social smokers ($p<0.05$) and had lower quit intentions ($p<0.05$). Segment 3 members (who also preferred the social warning) were significantly less likely to have made a recent quit attempt ($p<0.01$).

DISCUSSION

Irrespective of the task undertaken, smokers valued tobacco branding and were prepared to pay a premium to maintain this attribute. Both approaches used arrived at very similar estimates of branded packs' 'consumer surplus', and our estimates align with Thrasher *et al*'s²⁷ findings, involving US smokers, despite the fact we used hypothetical WTP while they employed

binding auction bids. Overall, our findings help quantify earlier studies documenting how smokers value tobacco branding,^{1-3 6} and illustrate how standardised packaging affects different smoker subgroups.

Our aggregate estimates disguise differences in the estimated consumer surplus for three preference segments as well as differences in their demographic characteristics and responses to different warning themes. Future work examining additional pictorial warnings could test the stability of these preference patterns. Respondents' differing reactions to the warnings tested suggest varied warning messages are required to trigger cessation

Table 5 Characteristics of preference segments

Characteristic	Segment 1%	Segment 2%	Segment 3%
Gender			
Male	47	54	54
Female	53	46	46
Age group (years)			
18–34	33	41	43
35–54	40	45	41
55 and older	26*	14	17
Ethnicity			
NZ European/other	86**	73	76
Māori/Pacific	8	16	10
Asian	6	11	14
Education			
Low	43	40	49
Medium	23	33	23
High	34	27	28
Income (NZ\$)			
Less than \$20 000	24	25	29
\$20 000–\$50 000	44	41	43
More than \$50 000	32	33	28
Smoking status			
Daily smoker	74	80**	66
Social/occasional smoker	26	20	34
Heaviness of smoking index			
Light	42	42	50
Moderate	43	41	41
Heavy	15	17	10
Cigarette type			
Factory made	67	65	64
Roll your own	33	35	36
Recent quit attempt			
Yes	37	35	18
No	63	65	82***
Quit intention			
Mean	6.2	5.4**	5.5

Significance of attribute in predicting segment membership.

* $p<0.1$ ** $p<0.05$ *** $p<0.01$.

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attempts among diverse smoker groups. To test how brand preference affects smokers' WTP for a branded pack, future work could focus more explicitly on groups where smoking prevalence peaks, collect data on the brand respondents smoke, or recruit only smokers of specific brands and direct them to stimuli featuring those brands.

Our study has some limitations; although we estimated choice behaviour, we did not examine actual behaviour. A field experiment could reveal how smokers respond to the pack attributes we tested and assess how well WTP estimates correspond to actual behaviour. Our sample under-represented Māori and Pacific peoples and tended to be better educated and more affluent than the average New Zealand smoker population, consequently our results may overestimate consumer surplus for smokers in general. Also, there is evidence of overestimation bias in hypothetical WTP studies, which may have affected our results. However, our sample estimates are likely to be conservative since respondents had no emotional affinity with the unfamiliar brand tested, as they would have had for their own preferred brand. The fact that respondents completed the WTP experiment after the choice study may have created a priming effect for this experiment. While we cannot dismiss this possibility, the similarity between the consumer surplus estimates of the WTP and choice findings, and between our results and those reported by Thrasher *et al*,²⁷ suggests any such effect is small.

As explained earlier, we did not evaluate standardised packaging independently of the increased warning label size as legislation implemented, or awaiting implementation does not simply remove brand imagery, but replaces it with a larger warning. The consumer surplus we have estimated thus reflects both the larger warning label size and the removal of brand imagery. While we cannot parse out the relative contribution of each component, we note earlier work has found removing brand imagery accounts for a significant proportion of the reduced pack appeal and purchase intention.²⁵

Our findings offer new insights into the effects on smokers of standardised packaging, and extend the evidence base supporting this measure. Earlier studies have shown that standardised packaging will reduce the appeal of cigarettes to young people, and hence deter youth experimentation.^{6 13–15} Our findings suggest this measure will also reduce demand among existing smokers, for whom standardised packaging represents a loss in product value. Combining price and non-price interventions, for example, by implementing standardised packaging alongside excise tax increases, would increase the actual cost and decrease the perceived value of smoking, thus bringing public health benefits to smokers and non-smokers alike.

What this paper adds

- A choice experiment and a willingness-to-pay study found smokers would pay a premium for a branded pack relative to a 'plain' pack; the choice study revealed older smokers, as well as those who had not made recent quit attempts, placed the highest value on branding.
- The experiments suggest that standardised packaging would potentially have a similar overall effect on smoking prevalence as a 5% tobacco price increase.
- The findings extend earlier work that found standardised packaging will reduce the appeal of smoking among young people by suggesting it will also reduce smoking among existing smokers, thus bringing notable population-level benefits.

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Contributors PG and JH conceptualised and designed the project; with TF, PG and JH designed the questionnaire and oversaw the data collection. JL designed the choice experiment, oversaw data analysis and commented on several draft versions of the manuscript. PG undertook initial data analyses and, with JH, led the manuscript development. CE led the analysis and interpretation of the choice data, and contributed to several versions of the manuscript. JH and PG supervised TF, who undertook initial analyses of the willingness-to-pay (WTP) data and prepared a preliminary report on the study. PG, CE and JH revised the MS. NW and RE helped design the project, reviewed the questionnaire, and contributed to the final manuscript. All authors have seen and approved the final version; authors are listed in descending order of contribution. PG is guarantor of the manuscript.

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Estimating the 'consumer surplus' for branded versus standardised tobacco packaging

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