



**Socioeconomically disadvantaged smokers' ratings of plain and branded cigarette packaging: An experimental study**

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3 **Socioeconomically disadvantaged smokers' ratings of plain and branded cigarette**  
4 **packaging: An experimental study**  
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## ABSTRACT

**Objectives:** This study aimed to test the impact of plain packaging for cigarettes on brand appeal among highly socioeconomically disadvantaged smokers using the new design for cigarettes implemented in Australia, which combines plain packaging with larger health warning labels.

**Design:** A 2x2 factorial design trial embedded within a cross-sectional computer touchscreen survey. Data was collected between March and December 2012.

**Setting:** Socially disadvantaged welfare aid recipients were recruited through a large Social and Community Service Organisation in NSW, Australia.

**Participants:** N=354 smokers. The majority of the sample had not completed high school (64%), earned less than AUD\$300/week (55%) and received their income from Government payments (95%).

**Interventions:** Participants were randomised to one of four different pack conditions determined by brand name: Winfield versus Benson & Hedges, and packaging type: branded versus plain. Participants were required to rate their assigned pack on measures of brand appeal and purchase intentions.

**Results:** Plain packaging was associated with significantly reduced smoker ratings of 'positive pack characteristics' ( $p < 0.001$ ), 'positive smoker characteristics' ( $p = 0.003$ ), and 'positive taste characteristics' ( $p = 0.033$ ) in the Winfield brand name condition only. Across the four pack conditions, no main differences were found for 'negative smoker characteristic' ( $p = 0.427$ ) or 'negative harm characteristics' ( $p = 0.411$ ). In comparison to branded packaging, the presentation of plain packaging was associated with lower odds of smokers' purchase intentions (OR = 2.18, 95%CI = 1.34, 3.54;  $p = 0.002$ ).

**Conclusions:** Plain packs stripped of branding elements, featuring larger health warning labels, were associated with reduced positive cigarette brand image and purchase intentions among highly socioeconomically disadvantaged smokers.

## ARTICLE SUMMARY

### Article focus

- Previous simulation studies have shown that plain packaging for cigarettes is associated with reduced perceptions of brand appeal and cessation intentions, however none have been conducted with socially disadvantaged smokers who have among the highest smoking rates.
- This study tested the Australian Government's new plain pack design for cigarettes which combines plain packaging with larger pictorial health warning labels.

### Key messages

- This experimental simulation study found that plain packaging for cigarettes reduced positive brand appeal ratings and purchase intentions among socially disadvantaged smokers compared to branded cigarette packaging.
- In this study the plain pack condition tested the new design for plain cigarette packs in Australia, which combines plain packaging with larger health warning labels.
- The results of this study support the move toward plain packaging policies for cigarettes.

### Strengths and limitations of this study

- This study is the first to obtain a large sample of socially disadvantaged smokers' responses to a simulation of a one-off exposure to an important tobacco control policy development.
- Use of a convenience sample limits the external validity and generalizability of the results.
- Use of a wider range of brands for comparison is recommended for research in countries considering implementing plain packaging.

## INTRODUCTION

Smoking rates are disproportionately high among groups who experience multiple levels of disadvantage such as those with low income (26%),[1] Indigenous populations (50%),[2] the homeless (69% – 73%)[3, 4] and individuals with a mental illness (35% – 90%).[5-7]

Comparatively, the population smoking rate in Australia is 15%.[1] Therefore, evaluating tobacco control approaches for effectiveness with disadvantaged social groups is a priority.

Cigarette manufacturers use the cigarette pack to promote their product in a number of ways. The cigarette pack is highly visible to both the user and others,[8] and reinforces brand image.[9] Packaging distinguishes brands from competitors and communicates brand imagery, character and values.[9, 10] Pack design can also be used to target segments of the market. For example, packs targeting women typically use bright graphics and feminine colours, descriptor terms such as ‘slim’ and ‘thin’ and packaging with increased height and decreased width compared to standard packaging.[11] To engage the youth market, pack designs are novel, with fashionable designs and attractive imagery, have innovative pack construction (i.e. pack shape and method of opening), and promote ‘mild’ taste or ‘smoothness’.[12] Economy packs that emphasise quality are important for targeting low-income smokers, and often use design elements such as price-marking (printing product price on packaging).[13] Packaging has been particularly important in markets such as Australia where stringent advertising restrictions have long prohibited traditional avenues of advertising and promotion of brand and product.

Design elements of the cigarette pack are constructed to capture starter smokers, encourage brand-switching and brand loyalty, and to expand market share.[9, 13] Packaging colours, product descriptors, brand imagery and logos have all been shown to impact on the perceptions and experiences of the product.[14] A colour code for tobacco products is well established: lighter packaging colours are perceived to contain a product that is less harmful to health. Numerous studies have shown that smokers associate the colour ‘red’ with high strength and harshness, ‘blue’ as being mild, and anything progressively lighter as healthier or less harmful.[15, 16]. Similarly, many countries have banned the use of descriptor terms such as ‘light’, ‘mild’ and ‘low tar’ as cigarettes labelled with these terms are falsely perceived as being less harmful to health, and easier to give up.[16] Replacement terms such as ‘gold’, ‘silver’ and ‘smooth’ were still perceived as less harmful than regular varieties, suggesting that removal of both colours and descriptor terms may be more effective than the

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3 removal of either alone in reducing false beliefs about tobacco risk.[14] Health warning  
4 labels (HWLs) that use pictures, supportive text and take up larger portions of the pack space  
5 have been shown to increase the effectiveness of the warnings in communicating risk and  
6 promoting cessation.[17, 18] Specifically, in a cross-sectional survey in the US, Bansal-  
7 Travers *et al.*[17] found that participants selected larger, pictorial, and loss-framed HWLs as  
8 the most effective in communicating health risks.  
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14 Evidence from plain packaging simulation studies shows that progressively plainer cigarette  
15 packaging, incorporating larger HWLs and fewer branding elements, was perceived as less  
16 attractive,[19, 20] reduced false beliefs about tobacco risk[14, 17] and was associated with  
17 cessation intentions.[8, 20] Wakefield and colleagues have conducted a number of online  
18 simulation experiments, exposing participants to pack conditions which vary by brand,  
19 degree of plain packaging[19, 21] and HWL size.[20] The studies found that packs with  
20 progressively fewer branding elements were perceived as less appealing overall,[19] larger  
21 HWLs combined with plain packs reduced adolescents' positive ratings of packs,[21] and  
22 presentation of plain packs compared with branded packs increased participant intentions of  
23 not purchasing a pack.[20] Additionally, best-worst[8] and experimental auction[22] studies  
24 have found plain packs featuring large graphic HWLs were the most effective pack type in  
25 reducing demand and promoting cessation among adult smokers.  
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36 The Australian Government's *Tobacco Plain Packaging Act 2011*, legislated mandatory plain  
37 and standardised packaging on cigarettes sold in Australia which include dark colour,  
38 pictorial and supportive text HWLs that cover at least 75% front-of-pack and 90% back-of-  
39 pack, have all logos and branding removed, and use only specified font styles and sizes.[23]  
40 The legislation was introduced to reduce product appeal, increase the effectiveness of health  
41 warnings, and reduce misperceptions about the harms of smoking. Providing some early  
42 support, the first study to examine effects of plain packaging during the roll-out phase found  
43 that compared to smokers smoking from branded packs, smokers with plain packs were more  
44 likely to perceive their tobacco as being lower in both quality and satisfaction, to think about  
45 and prioritise quitting and to support the plain packaging policy.[24] While there is evidence  
46 of reduced appeal for plain packaging compared to branded packaging of tobacco products  
47 within the general population, it is important to investigate whether similar effects are likely  
48 to occur for groups experiencing social and financial hardship. The aim of this study was to  
49 examine brand appeal and purchase intentions associated with branded cigarette packs  
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3 compared to the new design Australian plain packs among a sample of socioeconomically  
4 disadvantaged smokers.  
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## 7 8 **METHODS**

### 9 **Design**

10 A two by two packaging type (branded versus plain) by brand name (Winfield versus Benson  
11 & Hedges (B&H)) factorial experimental design was used; randomly exposing participants to  
12 one out of a possible four cigarette pack conditions. Each participant completed a uniform  
13 series of pack ratings within the experimental condition they were assigned. Data were  
14 collected using a touchscreen computer between March and December 2012.  
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### 20 **Setting & Sample**

21 As the target population for the study was smokers with high social disadvantage, the sample  
22 was drawn from a service outlet of a large, national non-government, social and community  
23 service organisation (SCSO). The service provides 'emergency relief' welfare such as food  
24 vouchers, grocery items, and financial aid to individuals experiencing various forms of social  
25 and financial hardship in a large catchment area of Western Sydney, NSW. The client profile  
26 of SCSO's includes an over-representation of a number of disadvantaged groups including  
27 Aboriginal and Torres Strait Islanders, single parents, long-term unemployed, and those  
28 whose primary income is a government benefit.[25]  
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37 Those eligible to participate were clients aged over 18 years, able to comprehend English,  
38 and who were not too ill or distressed to take part (as judged by SCSO staff). Previous  
39 research has demonstrated high smoking prevalence rates of 60%-70% amongst SCSO  
40 clients.[26]  
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46 **Recruitment** Clients were introduced to the study when they attended the SCSO for their  
47 emergency relief appointment. SCSO staff explained that a touchscreen computer survey  
48 about smoking was being conducted and if clients were interested they were led to a private  
49 room where a Research Assistant (RA) provided further detailed information. The RA  
50 provided assistance to complete the survey if required. As the survey was anonymous, survey  
51 completion was taken as implied consent. Participants were reimbursed for their time with an  
52 AUD\$20 grocery voucher.  
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### Smoking status

Smoking status was assessed by asking “Do you currently smoke tobacco products?” with response options i) ‘Yes, daily’, ii) ‘Yes, at least once a week’, iii) ‘Yes, but less often than once a week’ and iv) ‘No, not at all’, followed by asking “Have you smoked at least 100 cigarettes or a similar amount of tobacco in your life” (yes/no/not sure). Those who reported to smoke daily, or who reported to smoke occasionally as well as having smoked at least 100 cigarettes in their life were classified as current smokers. Once smoking status was assessed non-smokers exited from the survey.

\*\*\*Figure 1 about here\*\*\*

### Presentation of experimental conditions

The study was conducted on a Dell Latitude XT3 (2.50 GHz processor) touchscreen computer, using Digivey version 4 software.[27] Participants were randomly allocated to one of four cigarette pack conditions by Digivey’s randomise function, which uses a pseudo random number generator provided by the underlying programming language (see: [http://msdn.microsoft.com/en-us/library/system.random\(v=vs.90\).aspx](http://msdn.microsoft.com/en-us/library/system.random(v=vs.90).aspx)). Branded pack conditions replicated cigarette packs available for purchase at the time of survey; plain pack conditions tested the new plain packaging design, combining plain packaging stripped of branding elements with larger HWLs. The four pack conditions were: a) Branded Winfield Blue 25; b) Plain Winfield Blue 25; c) Branded B&H Smooth 25, and; d) Plain B&H Smooth 25, see Figure 1. Within each pack condition, respondents were presented with a standard set of items to rate their assigned pack. All pack conditions featured the same HWL: ‘Smoking causes peripheral vascular disease’. The brands used were two of the most popular brand variants in Australia: Winfield (Blue 25) and B&H (Smooth 25).[28] Plain pack digital images were created using specifications outlined in the Australian Government’s *Tobacco Plain Packaging Act 2011*, while images of branded packs were supplied by the Centre for Behavioural Research in Cancer, Victoria, Australia.

### Outcome measures

Brand appeal

While viewing the assigned pack image, respondents were asked to rate packs on various pack, smoker and taste characteristic statements, see Table 1. These items were developed by



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2  
3 Wakefield and colleagues[19-21] based on past tobacco industry packaging studies used to  
4 assess pack attractiveness, brand imagery characteristics and perceived sensory attributes.  
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6 Among adult smokers, these items have variably been used as: individual outcome items;[19]  
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8 or combined to form four outcome scales and one individual item with inter-item reliability  
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10 statistics presented.[20]

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13 \*\*\*Table 1 about here\*\*\*  
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#### 16 17 Purchase intentions

18 Participants were presented with images of the two brand name options (Winfield and B&H)  
19 on a single screen and asked: “If you ran out of cigarettes and only the packs below were  
20 available in the store you went to, which would you be most tempted to buy?” Participants  
21 could choose between the two brand name images or select ‘I would not buy any’.  
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24 Participants who had previously viewed and rated a plain packaging image (i.e. Pack B or D;  
25 see Figure 1) received plain image response options, and those who had previously rated a  
26 branded packaging image (i.e. Pack A or C) received branded image response options at this  
27 question.  
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#### 32 33 Socio-demographic variables

34 Gender, age, income, income source, Aboriginal or Torres Strait Islander status, marital  
35 status, highest level of education and housing type were assessed.  
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#### 40 41 **Statistical Analyses**

42 Analyses were conducted using Stata v11 ([www.stata.com](http://www.stata.com)). Characteristics of participants  
43 are presented by intervention group to assess the success of the randomisation.  
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#### 46 47 Instrument evaluation

48 Brand appeal rating items were combined to form four scales and one stand-alone item in  
49 order to replicate the outcome measure structure of Wakefield *et al.*'s previous plain  
50 packaging study.[20] The outcome measures were: (1) positive pack characteristics - ‘popular  
51 among smokers’; ‘attractive’; ‘sophisticated’; ‘a brand you might try/smoke’; (2) positive  
52 smoker characteristics – ‘trendy’ and ‘successful’; (3) negative smoker characteristic –  
53 ‘boring’; (4) positive taste characteristics – ‘enjoyable to smoke’ and ‘satisfying in taste’; and  
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3 (5) negative harm characteristics – ‘high in tar and nicotine’ and ‘harmful to your health’.  
4 Although these measures have shown strong to moderate internal consistency on Cronbach’s  
5 alpha previously,[20] they have not been tested in the current population, thus we undertook  
6 Cronbach’s alpha assessment on scales with more than one item.  
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#### 10 Outcome measure assessment

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12 As the outcome variables were not normally distributed we used non-parametric methods for  
13 analysis. Median scores with 95% confidence intervals are presented graphically for each of  
14 the four pack conditions. Exploratory data analysis indicated that there may be a potential  
15 pack type by brand name interaction, i.e. the relationship between packaging types (branded  
16 versus plain packaging) differed for the two different cigarette brand names. As the study  
17 had limited statistical power to assess interaction effects, we did not formally test this, but  
18 undertook analysis considering the four pack conditions separately, rather than as a factorial  
19 design. The Kruskal-Wallis test was used as a global assessment of differences in factor  
20 scores among the four pack conditions. If the *p*-value for this test was <0.1, pairwise  
21 comparisons using the Wilcoxon rank sum test were undertaken to compare median scores  
22 between branded packaging and plain packaging for each of the two brand names. Odds ratio  
23 analyses were used to assess the effect of packaging type (branded versus plain) on purchase  
24 intention.  
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36 Sample size for this study was determined by requirements for another trial for which  
37 participants were recruited. Post hoc power calculations demonstrated that a sample of 350  
38 participants (approximately 85 in each of the pack type by brand name groups) would allow  
39 detection of differences in scores between branded and plain packaging (within each brand  
40 name) of approximately half a standard deviation, with 5% significance level and 90% power  
41 (to allow for some loss of power due to the use of non-parametric analyses).  
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## 48 RESULTS

### 49 Sample

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51 A total of 787 clients were approached by SCSO staff during the study period and 608 were  
52 eligible to be approached to participate by the RA. Of those, 581 (96%) completed the survey  
53 and 362 (62%) of these were identified as current smokers (daily and occasional). Eight  
54 smokers were excluded as they primarily used something other than manufactured or roll-  
55 your-own tobacco. The demographic details of the study participants in each intervention  
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3 group are presented in Table 2. The majority of the sample had not finished high school  
4 (64%), earned less than AUD\$300/week (55%) and received their income from Government  
5 benefit payments (95%). Socio-demographic characteristics were similar across the four  
6 intervention groups.  
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11 \*\*\*Table 2 about here\*\*\*  
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### 14 15 16 **Brand Appeal Ratings**

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18 Scale reliability assessments revealed the outcome measures had moderate to strong internal  
19 consistency: positive pack characteristics ( $\alpha = .83$ ); positive smoker characteristics ( $\alpha = .71$ );  
20 positive taste ( $\alpha = .84$ ), and; negative harm characteristics ( $\alpha = .65$ ).  
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25 \*\*\*Figure 2 about here\*\*\*  
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28 Figure 2 displays ratings across the four pack conditions on the positive pack (2a), positive  
29 smoker (2b), negative smoker (2c), positive taste (2d), and negative harm (2e) response  
30 scales. The positive pack scale varied significantly across the pack conditions ( $p = 0.001$ ),  
31 with pairwise comparisons revealing that branded packaging images were rated significantly  
32 more positively than plain packaging images in the Winfield condition ( $p < 0.001$ ), however  
33 there was no difference in the B&H condition ( $p = 0.102$ ), see Table 3. Positive smoker  
34 characteristic ratings were significantly different across the four pack conditions ( $p = 0.003$ );  
35 branded packaging images were rated more positively than plain packaging images within the  
36 Winfield condition ( $p = 0.001$ ), but not the B&H brand name condition ( $p = 0.197$ ), see Table  
37 3. There was no difference in the negative smoker characteristic ratings across the four pack  
38 conditions ( $p = 0.427$ ). The four pack conditions were rated significantly differently when  
39 assessing positive taste characteristics ( $p = 0.033$ ). Pairwise comparisons revealed plain  
40 packaging images were less appealing on taste attributes than branded packaging images for  
41 the Winfield condition ( $p = 0.004$ ), however there were no differences detected in taste  
42 ratings between plain and branded packaging images in the B&H condition. The four pack  
43 conditions rated similarly in regards to negative harm characteristics ( $p = 0.411$ ) as shown in  
44 Figure 2e and Table 3.  
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### Purchase Intent

Participants were asked to choose which pack, if any, they would prefer to purchase out of the two brand names used in this study. Participants who viewed plain packaging images only were more likely to select that they would not buy any of the presented options (35%), compared to those who viewed branded packaging images (19%) [OR = 2.2, 95%CI = 1.3, 3.5;  $p = 0.002$ ].

### DISCUSSION

This study found that plain cigarette packs were rated as significantly less appealing than branded packs in a sample of socioeconomically disadvantaged smokers. Branded packaging was viewed as more appealing, smokers of these packs were rated in a more positive way, and the cigarette taste was preferred compared to cigarettes in plain packaging. No differences between branded and plain packaging relating to negative smoker or negative harm characteristics were detected. Finally, plain packaging reduced cigarette purchase intentions in comparison to branded packaging among smokers. The overall results of this study are supportive of previous plain packaging simulation research conducted with general population samples suggesting that plain packs are viewed less favourably on measures of brand appeal than branded packs.[19, 20]

One unexpected finding of this research was a possible interaction effect between packaging type (branded versus plain) and brand name (Winfield versus B&H). Plain pack images were rated consistently lower than branded images on measures of positive pack, positive smoker and positive taste appeal for the Winfield condition, but no differences were detected for the B&H condition. This sample of smokers may have less experience with the B&H brand, positioned as a 'premium' brand in Australia with a higher recommended retail price than the Winfield brand, which is considered a 'mainstream' brand offering value for money.[29] While 19% of the sample reported regularly using the Winfield brand only 1.6% reported regularly using B&H cigarettes, compared to 19% and 9%, respectively, in the general population.[28] It could be interpreted that the effect of plain packaging may be stronger for personally relevant brands, or brands within market segmentations relevant to the smoker.

Similarly to Wakefield *et al.*'s previous simulation studies, this study found no difference between plain and branded cigarette packaging on negative harm ratings. This may indicate

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3 that the removal of branding elements such as colours, logos, and fonts on packs is more  
4 effective in reducing brand appeal associations rather than tapping into negative harm  
5 perceptions. It is also likely that the measures used in this study, intended to assess brand  
6 appeal, were not adequate to assess negative harm perceptions related to packaging. There  
7 are, however, other simulation studies that indicate plain packaging reduces false beliefs  
8 about smoking[14] and increases cessation intentions.[8] Our study also found that the  
9 presentation of plain packaging, compared to branded packaging, reduced purchase intentions  
10 among socioeconomically disadvantaged smokers, consistent with previous simulations  
11 conducted with general population smokers.[20, 22]  
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### 20 **Implications**

21 The results of this study support the move toward plain packaging policies for cigarettes.  
22 Most research used in the development of plain packaging policies was conducted with  
23 general population samples, with limited data to indicate how socioeconomically  
24 disadvantaged groups, who have among the highest smoking rates, may respond to this  
25 tobacco control policy. The current study indicates that socioeconomically disadvantaged  
26 smokers are likely to respond similarly to the general population, with plain packaging  
27 reducing brand appeal ratings and purchase intentions among these smokers. Further  
28 research, particularly in low-income countries could provide insight about the possibility of  
29 disseminating this policy internationally.  
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38 Early research in Australia indicates plain packaging makes tobacco less appealing and  
39 increases the urgency to quit smoking,[24] however it will be important to monitor impact  
40 over time. Plain packaging policies have the potential to reduce smoking initiation.  
41 Associations with brand identity and appeal are motivating factors in smoking uptake among  
42 youth.[30, 31] There are documented cases of cigarette rebranding, for example the  
43 development of the Camel 'Smooth Character', to appeal to young adult smokers with the  
44 explicit intentions of increasing market share and prevalence of smoking among youth.[32]  
45 Plain packaging policies prevent this kind of brand targeting and have the potential to reduce  
46 uptake among youth by reducing brand appeal and purchase intentions. It will also be  
47 important to assess the use of any avoidance strategies, such as pack stickers and cigarette  
48 cases, and to monitor whether these are temporary solutions, or whether on-going changes to  
49 policy are required.  
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### Strengths and Limitations

The primary limitation of the study is its reliance on a convenience sample limiting its external validity and generalizability. However, socially disadvantaged groups are notoriously difficult to recruit and retain in health research.[33, 34] Recruitment challenges were overcome by accessing community services as recruitment sites and using convenience samples. As a result, this study is the first to obtain a large sample of socially disadvantaged smokers' responses to a simulation of a one-off exposure to an important tobacco control policy development. Since the policy has been implemented, socially disadvantaged smokers' day-to-day experience is one of being exposed to these plain packs multiple times a day, and so the findings from this study may underestimate the real world effects of this change. This study was also limited by the use of only two cigarette brands for comparison. Use of a wider range of brands for comparison is recommended for research in countries considering implementing plain packaging.

As this study tested the Australian Government's new plain pack design, which combines plain packaging with larger HWLs, we were unable to distinguish which factor (plain packaging or larger HWLs) produced the observed results. Previously, Wakefield *et al.*[20] examined the importance of branding versus HWL size on cigarette packaging, concluding that plain packaging reduced elements of brand appeal far more than increasing the size of HWLs. In their study, when packs were plain, increasing the size of HWLs above 30% did not reduce brand appeal further. This finding suggests that the effects observed in the current study are more likely due to stripping the pack of branding elements, than increasing the HWL size.

### Conclusions

The findings of this study support plain packaging policy, and show this strategy has the potential to reduce positive associations with cigarette packs among a group of highly socioeconomically disadvantaged smokers. It will be important to monitor the long-term outcomes of plain packaging policy, particularly with regards to uptake of smoking in disadvantaged groups. Further plain pack research in low-income countries is recommended, to support the potential dissemination of the policy internationally.

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**COMPETING INTERESTS**

None to declare.

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**ETHICS APPROVAL**

University of Newcastle's Human Research Ethics Committee.

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**Table 1.** Standard items used to assess responses to pack images.

Survey items	Response scale
<b>Pack characteristics:</b> <i>How well do you think the following phrases relate to the cigarette pack shown?</i>	Visual analogue scale: 1 (not at all) to 7 (extremely)
This pack is popular among smokers	
This pack is attractive	
This pack is sophisticated	
This pack is a brand you might try/smoke	
<b>Smoker characteristics:</b> <i>How well do you think the following characteristics describe a typical smoker of the pack shown?</i>	Visual analogue scale: 1 (not at all) to 7 (extremely)
A typical smoker of this pack is trendy	
A typical smoker of this pack is boring	
A typical smoker of this pack is successful	
<b>Taste attributes:</b> <i>Please rate the following phrases describing the taste of cigarettes from the pack shown.</i>	Visual analogue scale: 1 (not at all) to 7 (extremely)
I would expect the cigarettes in this pack to be enjoyable to smoke	
I would expect the cigarettes in this pack to be high in tar and nicotine	
I would expect the cigarettes in this pack to be satisfying in taste	
I would expect the cigarettes in this pack to be harmful to your health	

**Table 2.** Demographic characteristics of the survey sample ( $N = 354$ ).

Characteristic	Winfield	Winfield	B&H	B&H	Total
	Branded	Plain	Branded	Plain	
	N (%)	N (%)	N (%)	N (%)	N (%)
<i>N</i>	92 (26)	95 (27)	88 (25)	79 (22)	354
<b>Age</b>					
18 – 39	56 (61)	51 (54)	51 (58)	48 (61)	206 (58)
40+	36 (39)	44 (46)	37 (42)	31 (39)	148 (42)
<b>Gender</b>					
Female	61 (66)	46 (52)	66 (70)	43 (54)	216 (61)
<b>Aboriginal and/or Torres Strait Islander</b>					
Yes	23 (25)	14 (16)	17 (18)	10 (13)	64 (18)
<b>Marital Status</b>					
Married / De facto / Living with partner	29 (32)	15 (17)	23 (24)	20 (25)	87 (25)
Separated / Divorced	27 (29)	29 (33)	27 (28)	20 (25)	103 (29)
Never married / Single / Widowed	36 (39)	44 (50)	45 (47)	39 (49)	164 (46)
<b>Highest Education</b>					
Primary school	0 (0)	4 (5)	4 (4)	4 (5)	12 (3.4)
High school years 7-10	62 (67)	54 (61)	59 (62)	39 (49)	214 (61)
High school years 11-12	11 (12)	13 (15)	13 (14)	14 (18)	51 (14)
TAFE / trade qualification	14 (16)	13 (15)	16 (17)	21 (27)	64 (18)
University degree	5 (5)	4 (5)	3 (3)	1 (1)	13 (3.7)
<b>Personal Weekly Income</b>					
<\$299	54 (59)	55 (58)	48 (56)	38 (48)	195 (55)
>\$300	36 (39)	33 (35)	31 (35)	37 (47)	137 (39)
Prefer not to answer	2 (2)	7 (7)	9 (10)	4 (5)	22 (6)
<b>Income source</b>					
Paid work	6 (7)	2 (2)	4 (4)	1 (1)	13 (3.7)
Government payment (Centrelink)	85 (92)	85 (97)	89 (94)	76 (96)	335 (95)
Other	1 (1)	1 (1)	2 (2)	2 (3)	6 (1.7)
<b>Housing type</b>					
Own house/private rental	26 (28)	31 (33)	28 (32)	23 (29)	108 (31)
Government rental	55 (60)	42 (44)	44 (50)	43 (54)	184 (52)
Homeless/Supported accommodation	11 (12)	22 (23)	16 (18)	13 (17)	62 (18)
<b>Regular cigarette brand</b>					
Winfield	10 (17)	16 (21)	14 (24)	10 (18)	50 (20)
Benson & Hedges	1 (1.7)	1 (1.3)	2 (3.5)	0 (0)	4 (1.6)
Other	36 (62)	50 (65)	34 (59)	36 (66)	156 (63)
I don't have a regular brand	11 (19)	10 (13)	8 (14)	9 (16)	38 (15)

**Table 3.** Effect of pack condition on brand appeal ratings ( $N = 354$ ).

	<i>Pack Condition</i>				<i>Global test</i>	<i>Pairwise</i>	
	<i>Winfield_Branded</i>	<i>Winfield_Plain</i>	<i>B&amp;H_Branded</i>	<i>B&amp;H_Plain</i>		<i>Winfield (branded v plain)</i>	<i>Benson&amp;Hedges (branded v plain)</i>
	<i>(n = 92)</i>	<i>(n = 95)</i>	<i>(n = 88)</i>	<i>(n = 79)</i>	<i>P</i>	<i>P</i>	<i>P</i>
	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>			
Positive pack	3.86 (3.5 – 4.25)	2.25 (2 – 2.5)	2.63 (2.07 – 3.25)	2.5 (1.75 – 2.75)	<0.001	<0.001	0.102
Positive smoker	2.5 (2 – 3.5)	1 (1 – 2)	2.5 (2 – 3)	2.5 (1.5 – 2.87)	0.003	0.001	0.197
Negative smoker (boring)	2 (1 – 3)	2 (1 – 2)	2 (1 – 3)	3 (1.27 – 3.73)	0.427	n/a	n/a
Positive taste	4 (3.5 – 4.5)	3 (2.11 – 3.5)	3.75 (3 – 4)	3 (2 – 4)	0.033	0.004	0.804
Negative harm	5.5 (4.55 – 6)	5.5 (4.5 – 6)	4.5 (4 – 5.5)	6 (5.14 – 6.5)	0.411	n/a	n/a

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Original Branded Packaging

Plain Packaging



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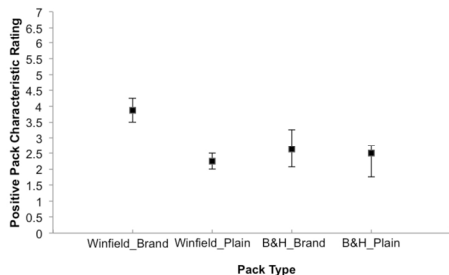
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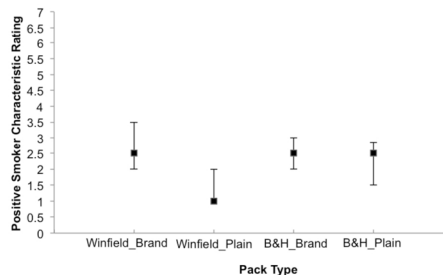
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Figure 1. Pack image used for each pack condition within the two by two packaging type (branded versus plain) by brand name (Winfield versus Benson & Hedges) between-subject experimental design. 150x183mm (300 x 300 DPI)

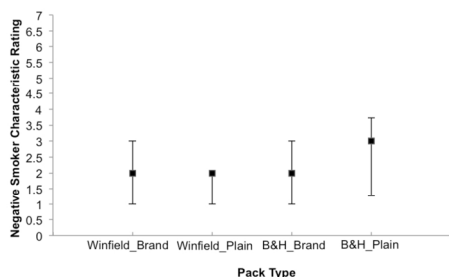
a) Positive Pack Characteristic Response Scale



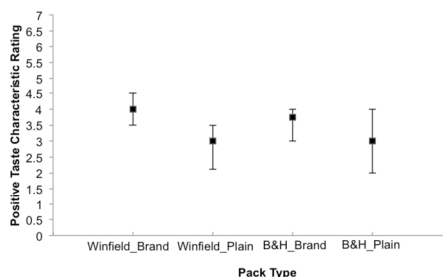
b) Positive Smoker Characteristic Response Scale



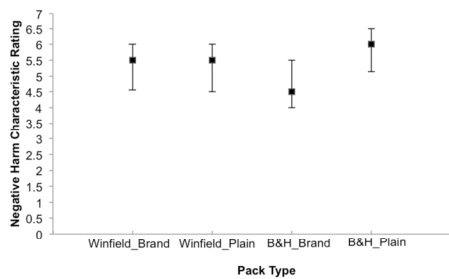
c) Negative Smoker Characteristic Response Scale



d) Positive Taste Characteristic Response Scale



e) Negative Harm Characteristic Response Scale



\*B&H refers to the Benson & Hedges brand name condition.

Figure 2. Median ratings with 95%CI for each response scale by pack condition (N = 354).  
173x212mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Yes
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Yes
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Yes
Objectives	3	State specific objectives, including any prespecified hypotheses	Yes
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Yes
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Yes
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Yes
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Yes
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Yes
Bias	9	Describe any efforts to address potential sources of bias	Yes
Study size	10	Explain how the study size was arrived at	Yes
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Yes
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Yes
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	NA
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	NA
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Yes
		(b) Give reasons for non-participation at each stage	Yes
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Yes
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Yes
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA
		(b) Report category boundaries when continuous variables were categorized	NA
		(c) If relevant, consider translating estimates of relative risk into absolute risk for	NA



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		a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Yes
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Yes
Generalisability	21	Discuss the generalisability (external validity) of the study results	Yes
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Yes

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).



**Socioeconomically disadvantaged smokers' ratings of plain and branded cigarette packaging: An experimental study**

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-004078.R1
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<b>Primary Subject Heading</b>:	Smoking and tobacco
Secondary Subject Heading:	Health policy, Public health
Keywords:	Social disadvantage, Plain packaging, Tobacco

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Manuscripts

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3 **Socioeconomically disadvantaged smokers' ratings of plain and branded cigarette**  
4 **packaging: An experimental study**  
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9 Ashleigh Guillaumier<sup>1</sup>, Billie Bonevski<sup>1</sup>, Chris Paul<sup>2</sup>, Sarah Durkin<sup>4</sup>, Catherine D'Este<sup>3</sup>  
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40 **Running head:** Disadvantaged smokers and plain packaging  
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## ABSTRACT

**Objectives:** This study aimed to test the potential impact of plain packaging for cigarettes on brand appeal among highly socioeconomically disadvantaged smokers using the new design for cigarettes implemented in Australia, which combines plain packaging with larger health warning labels.

**Design:** A 2x2 factorial design trial embedded within a cross-sectional computer touchscreen survey. Data was collected between March and December 2012.

**Setting:** Socially disadvantaged welfare aid recipients were recruited through a large Social and Community Service Organisation in NSW, Australia.

**Participants:** N=354 smokers. The majority of the sample had not completed high school (64%), earned less than AUD\$300/week (55%) and received their income from Government payments (95%).

**Interventions:** Participants were randomised to one of four different pack conditions determined by brand name: Winfield versus Benson & Hedges, and packaging type: branded versus plain. Participants were required to rate their assigned pack on measures of brand appeal and purchase intentions.

**Results:** Plain packaging was associated with significantly reduced smoker ratings of 'positive pack characteristics' ( $p < 0.001$ ), 'positive smoker characteristics' ( $p = 0.003$ ), and 'positive taste characteristics' ( $p = 0.033$ ) in the Winfield brand name condition only. Across the four pack conditions, no main differences were found for 'negative smoker characteristic' ( $p = 0.427$ ) or 'negative harm characteristics' ( $p = 0.411$ ). In comparison to plain packaging, the presentation of branded packaging was associated with higher odds of smokers' purchase intentions (OR = 2.18, 95%CI = 1.34, 3.54;  $p = 0.002$ ).

**Conclusions:** Plain packs stripped of branding elements, featuring larger health warning labels, were associated with reduced positive cigarette brand image and purchase intentions among highly socioeconomically disadvantaged smokers.

## ARTICLE SUMMARY

### Article focus

- Previous simulation studies have shown that plain packaging for cigarettes is associated with reduced perceptions of brand appeal, reduced demand and cessation intentions, however none have been conducted with socially disadvantaged smokers who have among the highest smoking rates.
- This study tested the Australian Government's new plain pack design for cigarettes which combines plain packaging with larger pictorial health warning labels.

### Key messages

- This experimental simulation study found that plain packaging for cigarettes reduced positive brand appeal ratings and purchase intentions among socially disadvantaged smokers compared to branded cigarette packaging.
- In this study the plain pack condition tested the new design for plain cigarette packs in Australia, which combines plain packaging with larger health warning labels.
- The results of this study support the move toward plain packaging policies for cigarettes.

### Strengths and limitations of this study

- This study is the first to obtain a large sample of socially disadvantaged smokers' responses to a simulation of a one-off exposure to an important tobacco control policy development.
- Use of a convenience sample limits the external validity and generalizability of the results.
- Use of a wider range of brands for comparison is recommended for research in countries considering implementing plain packaging.

## INTRODUCTION

Smoking rates are disproportionately high among groups who experience multiple levels of disadvantage such as those with low income (26%),[1] Indigenous populations (50%),[2] the homeless (69% – 73%)[3, 4] and individuals with a mental illness (35% – 90%).[5-7]

Comparatively, the population smoking rate in Australia is 15%. [1] Therefore, evaluating tobacco control approaches for effectiveness with disadvantaged social groups is a priority.

Cigarette manufacturers use the cigarette pack to promote their product in a number of ways. The cigarette pack is highly visible to both the user and others,[8] and reinforces brand image.[9] Packaging distinguishes brands from competitors and communicates brand imagery, character and values.[9, 10] Pack design can also be used to target segments of the market. For example, packs targeting women typically use bright graphics and feminine colours, descriptor terms such as ‘slim’ and ‘thin’ and packaging with increased height and decreased width compared to standard packaging.[11] To engage the youth market, pack designs are novel, with fashionable designs and attractive imagery, have innovative pack construction (i.e. pack shape and method of opening), and promote ‘mild’ taste or ‘smoothness’.[12] Economy packs that emphasise quality are important for targeting low-income smokers, and often use design elements such as printing product price on packaging.[13] Packaging has been particularly important in markets such as Australia where stringent advertising restrictions have long prohibited traditional avenues of advertising and promotion of brand and product.

Design elements of the cigarette pack are constructed to capture starter smokers, encourage brand-switching and brand loyalty, and to expand market share.[9, 13] Packaging colours, product descriptors, brand imagery and logos have all been shown to impact on the perceptions and experiences of the product.[14] A colour code for tobacco products is well established: lighter packaging colours are perceived to contain a product that is less harmful to health. Numerous studies have shown that smokers associate the colour ‘red’ with high strength and harshness, ‘blue’ as being mild, and anything progressively lighter as healthier or less harmful.[15, 16]. Similarly, many countries have banned the use of descriptor terms such as ‘light’, ‘mild’ and ‘low tar’ as cigarettes labelled with these terms are falsely perceived as being less harmful to health, and easier to give up.[16] Replacement terms such as ‘gold’, ‘silver’ and ‘smooth’ were still perceived as less harmful than regular varieties, suggesting that removal of both colours and descriptor terms may be more effective than the

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3 removal of either alone in reducing false beliefs about tobacco risk.[14] Health warning  
4 labels (HWLs) that use pictures, supportive text and take up larger portions of the pack space  
5 have been shown to increase the effectiveness of the warnings in communicating risk and  
6 promoting cessation.[17, 18] Specifically, in a cross-sectional survey in the US, Bansal-  
7 Travers *et al.*[17] found that participants selected larger, pictorial, and loss-framed HWLs as  
8 the most effective in communicating health risks.  
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14 Evidence from plain packaging simulation studies shows that progressively plainer cigarette  
15 packaging, incorporating larger HWLs and fewer branding elements, was perceived as less  
16 attractive,[19, 20] reduced false beliefs about tobacco risk[14, 17] and was associated with  
17 cessation intentions.[8, 20] Wakefield and colleagues have conducted a number of online  
18 simulation experiments, exposing participants to pack conditions which vary by brand,  
19 degree of plain packaging[19, 21] and HWL size.[20] The studies found that packs with  
20 progressively fewer branding elements were perceived as less appealing overall,[19] larger  
21 HWLs combined with plain packs reduced adolescents' positive ratings of packs,[21] and  
22 presentation of plain packs compared with branded packs increased participant intentions of  
23 not purchasing a pack.[20] However, none of these studies examined differences in effects by  
24 socioeconomic status (SES). Additionally, best-worst[8] and experimental auction[22] studies  
25 have found plain packs featuring large graphic HWLs were the most effective pack type in  
26 reducing demand and promoting cessation among adult smokers.  
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38 The Australian Government's *Tobacco Plain Packaging Act 2011*, legislated mandatory plain  
39 and standardised packaging on cigarettes sold in Australia which include dark colour,  
40 pictorial and supportive text HWLs that cover at least 75% front-of-pack and 90% back-of-  
41 pack, have all logos and branding removed, and use only specified font styles and sizes.[23]  
42 The policy also limits pack and stick dimensions. The legislation was introduced to reduce  
43 product appeal, increase the effectiveness of health warnings, and reduce misperceptions  
44 about the harms of smoking. The first study to examine effects of plain packaging during the  
45 roll-out phase using a computer-assisted telephone survey found that compared to smokers  
46 smoking from branded packs, smokers with plain packs were more likely to perceive their  
47 tobacco as being lower in both quality and satisfaction, to think about and prioritise quitting  
48 and to support the plain packaging policy.[24] However, this study had a low representation  
49 of disadvantaged smokers, did not examine effects by SES and did not control for novelty of  
50 HWL content. While there is evidence of reduced appeal for plain packaging compared to  
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3 branded packaging of tobacco products within the general population, it is important to  
4 investigate whether similar effects are likely to occur for groups experiencing social and  
5 financial hardship. The aim of this study was to examine brand appeal and purchase  
6 intentions associated with branded cigarette packs compared to the new design Australian  
7 plain packs among a sample of socioeconomically disadvantaged smokers.  
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## 11 12 13 **METHODS**

### 14 15 **Design**

16 A two by two packaging type (branded versus plain) by brand name (Winfield versus Benson  
17 & Hedges (B&H)) factorial experimental design was used; randomly exposing participants to  
18 one out of a possible four cigarette pack conditions. Each participant completed a uniform  
19 series of pack ratings within the experimental condition they were assigned. Data were  
20 collected using a touchscreen computer between March and December 2012.  
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### 26 27 **Setting & Sample**

28 As the target population for the study was smokers with high social disadvantage, the sample  
29 was drawn from a service outlet of a large, national non-government, social and community  
30 service organisation (SCSO). The service provides ‘emergency relief’ welfare such as food  
31 vouchers, grocery items, and financial aid to individuals experiencing various forms of social  
32 and financial hardship in a large catchment area of Western Sydney, NSW. The client profile  
33 of SCSO’s includes an over-representation of disadvantaged groups including Aboriginal and  
34 Torres Strait Islanders, single parents, long-term unemployed, and those whose primary  
35 income is a government benefit.[25]  
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43 Those eligible to participate were clients aged over 18 years, able to comprehend English,  
44 and who were not too ill or distressed to take part (as judged by SCSO staff). Previous  
45 research has demonstrated high smoking prevalence rates of 60%-70% amongst SCSO  
46 clients.[26]  
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### 51 52 **Recruitment**

53 Clients were introduced to the study when they attended the SCSO for their emergency relief  
54 appointment. SCSO staff explained that a touchscreen computer survey about smoking was  
55 being conducted and if clients were interested they were led to a private room where a  
56 Research Assistant (RA) provided further detailed information. The RA provided assistance  
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3 to complete the survey if required. As the survey was anonymous, survey completion was  
4 taken as implied consent. Participants were reimbursed for their time with an AUD\$20  
5 grocery voucher.  
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### 8 9 **Smoking status**

10 Smoking status was assessed by asking “Do you currently smoke tobacco products?” with  
11 response options i) ‘Yes, daily’, ii) ‘Yes, at least once a week’, iii) Yes, but less often than  
12 once a week’ and iv) ‘No, not at all’, followed by asking “Have you smoked at least 100  
13 cigarettes or a similar amount of tobacco in your life” (yes/no/not sure). Those who reported  
14 to smoke daily, or who reported to smoke occasionally as well as having smoked at least 100  
15 cigarettes in their life were classified as current smokers. Once smoking status was assessed  
16 non-smokers exited from the survey.  
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24 \*\*\*Figure 1 about here\*\*\*  
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### 28 **Presentation of experimental conditions**

29 The study was conducted on a Dell Latitude XT3 (2.50 GHz processor) touchscreen  
30 computer, using Digivey version 4 software.[27] Participants were randomly allocated to one  
31 of four cigarette pack conditions by Digivey’s randomise function, which uses a pseudo  
32 random number generator provided by the underlying programming language (see:  
33 [http://msdn.microsoft.com/en-us/library/system.random\(v=vs.90\).aspx](http://msdn.microsoft.com/en-us/library/system.random(v=vs.90).aspx)). Branded pack  
34 conditions replicated cigarette packs available for purchase at the time of survey; plain pack  
35 conditions tested the new plain packaging design, combining plain packaging stripped of  
36 branding elements with larger HWLs. The four pack conditions were: a) Branded Winfield  
37 Blue 25; b) Plain Winfield Blue 25; c) Branded B&H Smooth 25, and; d) Plain B&H Smooth  
38 25, see Figure 1. Within each pack condition, respondents were presented with a standard set  
39 of items to rate their assigned pack. All pack conditions featured the same graphic image and  
40 text HWL: ‘Smoking causes peripheral vascular disease’ that first appeared on Australian  
41 cigarette packs in 2006. The brands used were two of the most popular brand variants in the  
42 Australian mainstream (Winfield (Blue 25)) and premium (B&H (Smooth 25)) cigarette  
43 markets.[28] Plain pack digital images were created using specifications outlined in the  
44 Australian Government’s *Tobacco Plain Packaging Act 2011*, while images of branded packs  
45 were supplied by the Centre for Behavioural Research in Cancer, Victoria, Australia.  
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## Outcome measures

### Brand appeal

While viewing the assigned pack image, respondents were asked to rate packs on various pack, smoker and taste characteristic statements, see Table 1. These items were developed by Wakefield and colleagues[19-21] based on past tobacco industry packaging studies used to assess pack attractiveness, brand imagery characteristics and perceived sensory attributes. Among adult smokers, these items have variably been used as: individual outcome items;[19] or combined to form four outcome scales and one individual item with inter-item reliability statistics presented.[20]

Brand appeal rating items were combined to form four scales and one stand-alone item in order to replicate the outcome measure structure of Wakefield *et al.*'s previous plain packaging study.[20] The outcome measures were: (1) positive pack characteristics - 'popular among smokers'; 'attractive'; 'sophisticated'; 'a brand you might try/smoke'; (2) positive smoker characteristics - 'trendy' and 'successful'; (3) negative smoker characteristic - 'boring'; (4) positive taste characteristics - 'enjoyable to smoke' and 'satisfying in taste'; and (5) negative harm characteristics - 'high in tar and nicotine' and 'harmful to your health'. Although these measures have shown strong to moderate internal consistency on Cronbach's alpha previously,[20] they have not been tested in the current population, thus we undertook Cronbach's alpha assessment on scales with more than one item.

Scale reliability assessments revealed the outcome measures had moderate to strong internal consistency: positive pack characteristics ( $\alpha = .83$ ); positive smoker characteristics ( $\alpha = .71$ ); positive taste ( $\alpha = .84$ ), and; negative harm characteristics ( $\alpha = .65$ ).

\*\*\*Table 1 about here\*\*\*

### Purchase intentions

Participants were presented with images of the two brand name options (Winfield and B&H) on a single screen and asked: "If you ran out of cigarettes and only the packs below were available in the store you went to, which would you be most tempted to buy?" Participants could choose between the two brand name images or select 'I would not buy any'.

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3 Participants who had previously viewed and rated a plain packaging image (i.e. Pack B or D;  
4 see Figure 1) received plain image response options, and those who had previously rated a  
5 branded packaging image (i.e. Pack A or C) received branded image response options at this  
6 question.  
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#### 10 Socio-demographic variables

11 Gender, age, income, income source, Aboriginal or Torres Strait Islander status, marital  
12 status, highest level of education and housing type were assessed.  
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#### 17 **Statistical Analyses**

18 Analyses were conducted using Stata v11 ([www.stata.com](http://www.stata.com)). Characteristics of participants  
19 are presented by intervention group to assess the success of the randomisation.  
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#### 26 Outcome measure assessment

27 As the outcome variables were not normally distributed we used non-parametric methods for  
28 analysis. Median scores with 95% confidence intervals are presented graphically for each of  
29 the four pack conditions. Exploratory data analysis indicated that there may be a potential  
30 pack type by brand name interaction, i.e. the relationship between packaging types (branded  
31 versus plain packaging) differed for the two different cigarette brand names. As the study  
32 had limited statistical power to assess interaction effects, we did not formally test this, but  
33 undertook analysis considering the four pack conditions separately, rather than as a factorial  
34 design. The Kruskal-Wallis test was used as a global assessment of differences in factor  
35 scores among the four pack conditions. If the  $p$ -value for this test was  $<0.1$ , pairwise  
36 comparisons using the Wilcoxon rank sum test were undertaken to compare median scores  
37 between branded packaging and plain packaging for each of the two brand names. Odds ratio  
38 analyses were used to assess the effect of packaging type (branded versus plain) on purchase  
39 intention.  
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50 Sample size for this study was determined by requirements for another trial for which  
51 participants were recruited. Post hoc power calculations demonstrated that a sample of 350  
52 participants (approximately 85 in each of the pack type by brand name groups) would allow  
53 detection of differences in scores between branded and plain packaging (within each brand  
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3 name) of approximately half a standard deviation, with 5% significance level and 90% power  
4 (to allow for some loss of power due to the use of non-parametric analyses).  
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## 8 **RESULTS**

### 9 **Sample**

10 A total of 787 clients were approached by SCSO staff during the study period and 608 were  
11 eligible to be approached to participate by the RA. Of those, 581 (96%) completed the survey  
12 and 362 (62%) of these were identified as current smokers (daily and occasional). Eight  
13 smokers were excluded as they primarily used something other than manufactured or roll-  
14 your-own tobacco. The demographic details of the study participants in each intervention  
15 group are presented in Table 2. The majority of the sample had not finished high school  
16 (64%), earned less than AUD\$300/week (55%) and received their income from Government  
17 benefit payments (95%). Socio-demographic characteristics were similar across the four  
18 intervention groups.  
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### 33 **Brand Appeal Ratings**

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41 Figure 2 displays ratings across the four pack conditions on the positive pack (2a), positive  
42 smoker (2b), negative smoker (2c), positive taste (2d), and negative harm (2e) response  
43 scales. The positive pack scale varied significantly across the pack conditions ( $p = 0.001$ ),  
44 with pairwise comparisons revealing that branded packaging images were rated significantly  
45 more positively than plain packaging images in the Winfield condition ( $p < 0.001$ ), however  
46 there was no difference in the B&H condition ( $p = 0.102$ ), see Table 3. Positive smoker  
47 characteristic ratings were significantly different across the four pack conditions ( $p = 0.003$ );  
48 branded packaging images were rated more positively than plain packaging images within the  
49 Winfield condition ( $p = 0.001$ ), but not the B&H brand name condition ( $p = 0.197$ ), see Table  
50 3. There was no difference in the negative smoker characteristic ratings across the four pack  
51 conditions ( $p = 0.427$ ). The four pack conditions were rated significantly differently when  
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3 assessing positive taste characteristics ( $p = 0.033$ ). Pairwise comparisons revealed plain  
4 packaging images were less appealing on taste attributes than branded packaging images for  
5 the Winfield condition ( $p = 0.004$ ), however there were no differences detected in taste  
6 ratings between plain and branded packaging images in the B&H condition. The four pack  
7 conditions rated similarly in regards to negative harm characteristics ( $p = 0.411$ ) as shown in  
8 Figure 2e and Table 3.  
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14 \*\*\*Table 3 about here\*\*\*  
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### 18 **Purchase Intent**

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20 Participants were asked to choose which pack, if any, they would prefer to purchase out of  
21 the two brand names used in this study. Participants who viewed plain packaging images only  
22 were more likely to select that they would not buy any of the presented options (35%),  
23 compared to those who viewed branded packaging images (19%) [OR = 2.2, 95%CI = 1.3,  
24 3.5;  $p = 0.002$ ].  
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### 30 **DISCUSSION**

31  
32 This study found that plain cigarette packs were rated as significantly less appealing than  
33 branded packs in a sample of socioeconomically disadvantaged smokers. Branded packaging  
34 was viewed as more appealing, smokers of these packs were rated in a more positive way,  
35 and the cigarette taste was preferred compared to cigarettes in plain packaging. No  
36 differences between branded and plain packaging relating to negative smoker or negative  
37 harm characteristics were detected. Finally, plain packaging reduced cigarette purchase  
38 intentions in comparison to branded packaging among smokers. The overall results of this  
39 study are supportive of previous plain packaging simulation research conducted with general  
40 population samples suggesting that plain packs are viewed less favourably on measures of  
41 brand appeal than branded packs.[19, 20]  
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50 One notable finding of this research, demonstrating the importance of branding in the tobacco  
51 market, was a possible interaction effect between packaging type (branded versus plain) and  
52 brand name (Winfield versus B&H). Plain pack images were rated consistently lower than  
53 branded images on measures of positive pack, positive smoker and positive taste appeal for  
54 the Winfield condition, but no differences were detected for the B&H condition. It might be  
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3 expected that plain packaging of B&H cigarettes is unlikely to have much effect among  
4 socially disadvantaged smokers as this brand is positioned as a premium product at a high  
5 price point,[29] with apparent low penetration among this smoker group: only 1.6% of  
6 participants reported regularly using B&H cigarettes compared to 9% in the general  
7 population.[28] Comparatively, engagement with the ‘mainstream’, value-for-money  
8 Winfield brand is much higher among socially disadvantaged smokers: participants reported  
9 regularly using this brand at the same rate as the general population (19%).[28] Plain  
10 packaging has the potential to show stronger effects for brands that are personally relevant to  
11 the individual smoker.  
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19 Similarly to Wakefield *et al.*'s previous simulation studies, this study found no difference  
20 between plain and branded cigarette packaging on negative harm ratings. This may indicate  
21 that the removal of branding elements such as colours, logos, and fonts on packs is more  
22 effective in reducing brand appeal associations rather than tapping into negative harm  
23 perceptions. It is also likely that the measures used in this study, intended to assess brand  
24 appeal, were not adequate to assess negative harm perceptions related to packaging. It may  
25 also be the case that effects on perceived harm are stronger among youth compared to adults,  
26 as previous simulation studies indicate plain packaging reduces false beliefs about smoking  
27 among adolescents[14] and increases cessation intentions among young adults.[8] Our study  
28 also found that the presentation of plain packaging, compared to branded packaging, reduced  
29 purchase intentions among socioeconomically disadvantaged smokers, consistent with  
30 previous simulations conducted with general population smokers.[20, 22]  
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### 41 **Implications**

42 The results of this study support the move toward plain packaging policies for cigarettes.  
43 Most research used in the development of plain packaging policies was conducted with  
44 general population samples, with limited data to indicate how socioeconomically  
45 disadvantaged groups, who have among the highest smoking rates, may respond to this  
46 tobacco control policy. The current study indicates that socioeconomically disadvantaged  
47 smokers are likely to respond similarly to the general population, with plain packaging  
48 reducing brand appeal ratings and purchase intentions among these smokers. Further  
49 research, particularly in low-income countries could provide insight about the possibility of  
50 disseminating this policy internationally.  
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3 Early research in Australia indicates plain packaging makes tobacco less appealing and  
4 increases the urgency to quit smoking,[24] however it will be important to monitor impact  
5 over time. Plain packaging policies have the potential to reduce smoking initiation.  
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7 Associations with brand identity and appeal are motivating factors in smoking uptake among  
8 youth.[30, 31] There are documented cases of cigarette rebranding, for example the  
9 development of the Camel ‘Smooth Character’, to appeal to young adult smokers with the  
10 explicit intentions of increasing market share and prevalence of smoking among youth.[32]  
11 Plain packaging policies prevent this kind of brand targeting and have the potential to reduce  
12 uptake among youth by reducing brand appeal and purchase intentions. It will also be  
13 important to assess the use of any avoidance strategies, such as pack stickers and cigarette  
14 cases, and to monitor whether these are temporary solutions, or whether on-going changes to  
15 policy are required.  
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### 24 **Strengths and Limitations**

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26 The primary limitation of the study is its reliance on a convenience sample limiting its  
27 external validity and generalizability. However, socially disadvantaged groups are  
28 notoriously difficult to recruit and retain in health research.[33, 34] Recruitment challenges  
29 were overcome by accessing community services as recruitment sites and using convenience  
30 samples. As a result, this study is the first to obtain a large sample of socially disadvantaged  
31 smokers’ responses to a simulation of a one-off exposure to an important tobacco control  
32 policy development. Since the policy has been implemented, socially disadvantaged smokers’  
33 day-to-day experience is one of being exposed to these plain packs multiple times a day, and  
34 so the findings from this study may underestimate the real world effects of this change. This  
35 study was also limited by the measurement of purchase intentions rather than actual  
36 behaviour, the use of only two cigarette brands for comparison. Use of a wider range of  
37 brands for comparison is recommended for research in countries considering implementing  
38 plain packaging. Although the study employed a computer image instead of actual packs,  
39 previous packaging research demonstrates results are generally consistent regardless of  
40 stimulus presentation modality.[22, 35, 36] The outcome measures used in this study pose an  
41 additional limitation. Although they were selected for the purpose of comparing results with  
42 previous plain pack research,[19, 20] they have not been evaluated for validity or reliability  
43 and this should be assessed in the future.  
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3 As this study tested the Australian Government's new plain pack design, which combines  
4 plain packaging with larger HWLs, we were unable to distinguish which factor (plain  
5 packaging or larger HWLs) produced the observed results. Previously, Wakefield *et al.*[20]  
6 examined the importance of branding versus HWL size on cigarette packaging, concluding  
7 that plain packaging reduced elements of brand appeal far more than increasing the size of  
8 HWLs. In their study, when packs were plain, increasing the size of HWLs above 30% did  
9 not reduce brand appeal further. This finding suggests that the effects observed in the current  
10 study are more likely due to stripping the pack of branding elements, than increasing the  
11 HWL size. Finally, the last 2 – 3 months of survey occurred during the policy roll-out phase  
12 and participants may have already been exposed to and purchased plain packs. Prior exposure  
13 may have allowed participants to become familiar with the new pack designs, and may  
14 explain why participants did not rate packs differently on negative harm and smoker  
15 measures.  
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## 25 26 **Conclusions**

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28 The findings of this study support plain packaging policy, and show this strategy has the  
29 potential to reduce positive associations with cigarette packs among a group of highly  
30 socioeconomically disadvantaged smokers. It will be important to monitor the long-term  
31 outcomes of plain packaging policy, particularly with regards to uptake of smoking in  
32 disadvantaged groups. Further plain pack research in low-income countries is recommended,  
33 to support the potential dissemination of the policy internationally.  
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**CONTRIBUTORSHIP STATEMENT**

All authors contributed to the concept development and design of the project. AG led data collection, analysis and manuscript write-up. BB, CP and CDE oversaw data collection. CDE and SD advised on, and CDE oversaw data analysis. All authors contributed to manuscript drafts and approved of the final manuscript.

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**DATA SHARING STATEMENT**

No additional data are available.

**COMPETING INTERESTS**

None to declare.

**ETHICS APPROVAL**

University of Newcastle's Human Research Ethics Committee.

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**Table 1.** Standard items used to assess responses to pack images.

Survey items	Response scale
<b>Pack characteristics:</b> <i>How well do you think the following phrases relate to the cigarette pack shown?</i>	Response scale: 1 (not at all) to 7 (extremely)
This pack is popular among smokers	
This pack is attractive	
This pack is sophisticated	
This pack is a brand you might try/smoke	
<b>Smoker characteristics:</b> <i>How well do you think the following characteristics describe a typical smoker of the pack shown?</i>	Response scale: 1 (not at all) to 7 (extremely)
A typical smoker of this pack is trendy	
A typical smoker of this pack is boring	
A typical smoker of this pack is successful	
<b>Taste attributes:</b> <i>Please rate the following phrases describing the taste of cigarettes from the pack shown.</i>	Response scale: 1 (not at all) to 7 (extremely)
I would expect the cigarettes in this pack to be enjoyable to smoke	
I would expect the cigarettes in this pack to be high in tar and nicotine	
I would expect the cigarettes in this pack to be satisfying in taste	
I would expect the cigarettes in this pack to be harmful to your health	

**Table 2.** Demographic characteristics of the survey sample ( $N = 354$ ).

Characteristic	Winfield	Winfield	B&H	B&H	Total
	Branded	Plain	Branded	Plain	
	N (%)	N (%)	N (%)	N (%)	N (%)
<i>N</i>	92 (26)	95 (27)	88 (25)	79 (22)	354
<b>Age</b>					
18 – 39	56 (61)	51 (54)	51 (58)	48 (61)	206 (58)
40+	36 (39)	44 (46)	37 (42)	31 (39)	148 (42)
<b>Gender</b>					
Female	61 (66)	46 (52)	66 (70)	43 (54)	216 (61)
<b>Aboriginal and/or Torres Strait Islander</b>					
Yes	23 (25)	14 (16)	17 (18)	10 (13)	64 (18)
<b>Marital Status</b>					
Married / De facto / Living with partner	29 (32)	15 (17)	23 (24)	20 (25)	87 (25)
Separated / Divorced	27 (29)	29 (33)	27 (28)	20 (25)	103 (29)
Never married / Single / Widowed	36 (39)	44 (50)	45 (47)	39 (49)	164 (46)
<b>Highest Education</b>					
Primary school	0 (0)	4 (5)	4 (4)	4 (5)	12 (3.4)
High school years 7-10	62 (67)	54 (61)	59 (62)	39 (49)	214 (61)
High school years 11-12	11 (12)	13 (15)	13 (14)	14 (18)	51 (14)
TAFE / trade qualification	14 (16)	13 (15)	16 (17)	21 (27)	64 (18)
University degree	5 (5)	4 (5)	3 (3)	1 (1)	13 (3.7)
<b>Personal Weekly Income</b>					
<\$299	54 (59)	55 (58)	48 (56)	38 (48)	195 (55)
>\$300	36 (39)	33 (35)	31 (35)	37 (47)	137 (39)
Prefer not to answer	2 (2)	7 (7)	9 (10)	4 (5)	22 (6)
<b>Income source</b>					
Paid work	6 (7)	2 (2)	4 (4)	1 (1)	13 (3.7)
Government payment (Centrelink)	85 (92)	85 (97)	89 (94)	76 (96)	335 (95)
Other	1 (1)	1 (1)	2 (2)	2 (3)	6 (1.7)
<b>Housing type</b>					
Own house/private rental	26 (28)	31 (33)	28 (32)	23 (29)	108 (31)
Government rental	55 (60)	42 (44)	44 (50)	43 (54)	184 (52)
Homeless/Supported accommodation	11 (12)	22 (23)	16 (18)	13 (17)	62 (18)
<b>Regular cigarette brand</b>					
Winfield	10 (17)	16 (21)	14 (24)	10 (18)	50 (20)
Benson & Hedges	1 (1.7)	1 (1.3)	2 (3.5)	0 (0)	4 (1.6)
Other	36 (62)	50 (65)	34 (59)	36 (66)	156 (63)
I don't have a regular brand	11 (19)	10 (13)	8 (14)	9 (16)	38 (15)
<b>Regular tobacco type</b>					
Manufactured cigarettes	58 (63)	77 (81)	58 (66)	55 (70)	248 (70)
Roll-your-own tobacco	34 (37)	18 (19)	30 (34)	24 (30)	106 (30)

**Table 3.** Effect of pack condition on brand appeal ratings ( $N = 354$ ).

	<i>Pack Condition</i>				<i>Global test</i>	<i>Pairwise</i>	
	<i>Winfield_Branded</i>	<i>Winfield_Plain</i>	<i>B&amp;H_Branded</i>	<i>B&amp;H_Plain</i>		<i>Winfield (branded v plain)</i>	<i>Benson&amp;Hedges (branded v plain)</i>
	<i>(n = 92)</i>	<i>(n = 95)</i>	<i>(n = 88)</i>	<i>(n = 79)</i>	<i>P</i>	<i>P</i>	<i>P</i>
	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>			
Positive pack	3.86 (3.5 – 4.25)	2.25 (2 – 2.5)	2.63 (2.07 – 3.25)	2.5 (1.75 – 2.75)	<0.001	<0.001	0.102
Positive smoker	2.5 (2 – 3.5)	1 (1 – 2)	2.5 (2 – 3)	2.5 (1.5 – 2.87)	0.003	0.001	0.197
Negative smoker (boring)	2 (1 – 3)	2 (1 – 2)	2 (1 – 3)	3 (1.27 – 3.73)	0.427	n/a	n/a
Positive taste	4 (3.5 – 4.5)	3 (2.11 – 3.5)	3.75 (3 – 4)	3 (2 – 4)	0.033	0.004	0.804
Negative harm	5.5 (4.55 – 6)	5.5 (4.5 – 6)	4.5 (4 – 5.5)	6 (5.14 – 6.5)	0.411	n/a	n/a

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3 **Socioeconomically disadvantaged smokers' ratings of plain and branded cigarette**  
4 **packaging: An experimental study**  
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9 Ashleigh Guillaumier<sup>1</sup>, Billie Bonevski<sup>1</sup>, Chris Paul<sup>2</sup>, Catherine D'Este<sup>3</sup>, Sarah Durkin<sup>4</sup>  
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41 **Running head:** Disadvantaged smokers and plain packaging

42 **Keywords:** social disadvantage; plain packaging; tobacco

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## ABSTRACT

**Objectives:** This study aimed to test the potential impact of plain packaging for cigarettes on brand appeal among highly socioeconomically disadvantaged smokers using the new design for cigarettes implemented in Australia, which combines plain packaging with larger health warning labels.

**Design:** A 2x2 factorial design trial embedded within a cross-sectional computer touchscreen survey. Data was collected between March and December 2012.

**Setting:** Socially disadvantaged welfare aid recipients were recruited through a large Social and Community Service Organisation in NSW, Australia.

**Participants:** N=354 smokers. The majority of the sample had not completed high school (64%), earned less than AUD\$300/week (55%) and received their income from Government payments (95%).

**Interventions:** Participants were randomised to one of four different pack conditions determined by brand name: Winfield versus Benson & Hedges, and packaging type: branded versus plain. Participants were required to rate their assigned pack on measures of brand appeal and purchase intentions.

**Results:** Plain packaging was associated with significantly reduced smoker ratings of 'positive pack characteristics' ( $p < 0.001$ ), 'positive smoker characteristics' ( $p = 0.003$ ), and 'positive taste characteristics' ( $p = 0.033$ ) in the Winfield brand name condition only. Across the four pack conditions, no main differences were found for 'negative smoker characteristic' ( $p = 0.427$ ) or 'negative harm characteristics' ( $p = 0.411$ ). In comparison to branded-plain packaging, the presentation of plain-branded packaging was associated with lower-higher odds of smokers' purchase intentions (OR = 2.18, 95%CI = 1.34, 3.54;  $p = 0.002$ ).

**Conclusions:** Plain packs stripped of branding elements, featuring larger health warning labels, were associated with reduced positive cigarette brand image and purchase intentions among highly socioeconomically disadvantaged smokers.



## ARTICLE SUMMARY

### Article focus

- Previous simulation studies have shown that plain packaging for cigarettes is associated with reduced perceptions of brand appeal, reduced demand and cessation intentions, however none have been conducted with socially disadvantaged smokers who have among the highest smoking rates.
- This study tested the Australian Government's new plain pack design for cigarettes which combines plain packaging with larger pictorial health warning labels.

### Key messages

- This experimental simulation study found that plain packaging for cigarettes reduced positive brand appeal ratings and purchase intentions among socially disadvantaged smokers compared to branded cigarette packaging.
- In this study the plain pack condition tested the new design for plain cigarette packs in Australia, which combines plain packaging with larger health warning labels.
- The results of this study support the move toward plain packaging policies for cigarettes.

### Strengths and limitations of this study

- This study is the first to obtain a large sample of socially disadvantaged smokers' responses to a simulation of a one-off exposure to an important tobacco control policy development.
- Use of a convenience sample limits the external validity and generalizability of the results.
- Use of a wider range of brands for comparison is recommended for research in countries considering implementing plain packaging.

## INTRODUCTION

Smoking rates are disproportionately high among groups who experience multiple levels of disadvantage such as those with low income (26%),[1] Indigenous populations (50%),[2] the homeless (69% – 73%)[3, 4] and individuals with a mental illness (35% – 90%).[5-7]

Comparatively, the population smoking rate in Australia is 15%. [1] Therefore, evaluating tobacco control approaches for effectiveness with disadvantaged social groups is a priority.

Cigarette manufacturers use the cigarette pack to promote their product in a number of ways. The cigarette pack is highly visible to both the user and others,[8] and reinforces brand image.[9] Packaging distinguishes brands from competitors and communicates brand imagery, character and values.[9, 10] Pack design can also be used to target segments of the market. For example, packs targeting women typically use bright graphics and feminine colours, descriptor terms such as ‘slim’ and ‘thin’ and packaging with increased height and decreased width compared to standard packaging.[11] To engage the youth market, pack designs are novel, with fashionable designs and attractive imagery, have innovative pack construction (i.e. pack shape and method of opening), and promote ‘mild’ taste or ‘smoothness’.[12] Economy packs that emphasise quality are important for targeting low-income smokers, and often use design elements such as ~~price-marking~~ (printing product price on packaging).[13] Packaging has been particularly important in markets such as Australia where stringent advertising restrictions have long prohibited traditional avenues of advertising and promotion of brand and product.

Design elements of the cigarette pack are constructed to capture starter smokers, encourage brand-switching and brand loyalty, and to expand market share.[9, 13] Packaging colours, product descriptors, brand imagery and logos have all been shown to impact on the perceptions and experiences of the product.[14] A colour code for tobacco products is well established: lighter packaging colours are perceived to contain a product that is less harmful to health. Numerous studies have shown that smokers associate the colour ‘red’ with high strength and harshness, ‘blue’ as being mild, and anything progressively lighter as healthier or less harmful.[15, 16]. Similarly, many countries have banned the use of descriptor terms such as ‘light’, ‘mild’ and ‘low tar’ as cigarettes labelled with these terms are falsely perceived as being less harmful to health, and easier to give up.[16] Replacement terms such as ‘gold’, ‘silver’ and ‘smooth’ were still perceived as less harmful than regular varieties, suggesting that removal of both colours and descriptor terms may be more effective than the

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3 removal of either alone in reducing false beliefs about tobacco risk.[14] Health warning  
4 labels (HWLs) that use pictures, supportive text and take up larger portions of the pack space  
5 have been shown to increase the effectiveness of the warnings in communicating risk and  
6 promoting cessation.[17, 18] Specifically, in a cross-sectional survey in the US, Bansal-  
7 Travers *et al.*[17] found that participants selected larger, pictorial, and loss-framed HWLs as  
8 the most effective in communicating health risks.  
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14 Evidence from plain packaging simulation studies shows that progressively plainer cigarette  
15 packaging, incorporating larger HWLs and fewer branding elements, was perceived as less  
16 attractive,[19, 20] reduced false beliefs about tobacco risk[14, 17] and was associated with  
17 cessation intentions.[8, 20] Wakefield and colleagues have conducted a number of online  
18 simulation experiments, exposing participants to pack conditions which vary by brand,  
19 degree of plain packaging[19, 21] and HWL size.[20] The studies found that packs with  
20 progressively fewer branding elements were perceived as less appealing overall,[19] larger  
21 HWLs combined with plain packs reduced adolescents' positive ratings of packs,[21] and  
22 presentation of plain packs compared with branded packs increased participant intentions of  
23 not purchasing a pack.[20] However, none of these studies examined differences in effects by  
24 socioeconomic status (SES). Additionally, best-worst[8] and experimental auction[22] studies  
25 have found plain packs featuring large graphic HWLs were the most effective pack type in  
26 reducing demand and promoting cessation among adult smokers.  
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33 The Australian Government's *Tobacco Plain Packaging Act 2011*, legislated mandatory plain  
34 and standardised packaging on cigarettes sold in Australia which include dark colour,  
35 pictorial and supportive text HWLs that cover at least 75% front-of-pack and 90% back-of-  
36 pack, have all logos and branding removed, and use only specified font styles and sizes.[23]  
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38 The policy also limits pack and stick dimensions. The legislation was introduced to reduce  
39 product appeal, increase the effectiveness of health warnings, and reduce misperceptions  
40 about the harms of smoking. ~~Providing some early support, t~~The first study to examine  
41 effects of plain packaging during the roll-out phase using a computer-assisted telephone  
42 survey found that compared to smokers smoking from branded packs, smokers with plain  
43 packs were more likely to perceive their tobacco as being lower in both quality and  
44 satisfaction, to think about and prioritise quitting and to support the plain packaging  
45 policy.[24] However, this study had a low representation of disadvantaged smokers, did not  
46 examine effects by SES and did not control for novelty of HWL content. While there is  
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3 evidence of reduced appeal for plain packaging compared to branded packaging of tobacco  
4 products within the general population, it is important to investigate whether similar effects  
5 are likely to occur for groups experiencing social and financial hardship. The aim of this  
6 study was to examine brand appeal and purchase intentions associated with branded cigarette  
7 packs compared to the new design Australian plain packs among a sample of  
8 socioeconomically disadvantaged smokers.  
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## 13 14 15 **METHODS**

### 16 **Design**

17 A two by two packaging type (branded versus plain) by brand name (Winfield versus Benson  
18 & Hedges (B&H)) factorial experimental design was used; randomly exposing participants to  
19 one out of a possible four cigarette pack conditions. Each participant completed a uniform  
20 series of pack ratings within the experimental condition they were assigned. Data were  
21 collected using a touchscreen computer between March and December 2012.  
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### 28 **Setting & Sample**

29 As the target population for the study was smokers with high social disadvantage, the sample  
30 was drawn from a service outlet of a large, national non-government, social and community  
31 service organisation (SCSO). The service provides ‘emergency relief’ welfare such as food  
32 vouchers, grocery items, and financial aid to individuals experiencing various forms of social  
33 and financial hardship in a large catchment area of Western Sydney, NSW. The client profile  
34 of SCSO’s includes an over-representation ~~of a number~~ of disadvantaged groups including  
35 Aboriginal and Torres Strait Islanders, single parents, long-term unemployed, and those  
36 whose primary income is a government benefit.[25]  
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45 Those eligible to participate were clients aged over 18 years, able to comprehend English,  
46 and who were not too ill or distressed to take part (as judged by SCSO staff). Previous  
47 research has demonstrated high smoking prevalence rates of 60%-70% amongst SCSO  
48 clients.[26]  
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### 53 **Recruitment**

54 Clients were introduced to the study when they attended the SCSO for their emergency relief  
55 appointment. SCSO staff explained that a touchscreen computer survey about smoking was  
56 being conducted and if clients were interested they were led to a private room where a  
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3 Research Assistant (RA) provided further detailed information. The RA provided assistance  
4 to complete the survey if required. As the survey was anonymous, survey completion was  
5 taken as implied consent. Participants were reimbursed for their time with an AUD\$20  
6 grocery voucher.  
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### 10 11 **Smoking status**

12 Smoking status was assessed by asking “Do you currently smoke tobacco products?” with  
13 response options i) ‘Yes, daily’, ii) ‘Yes, at least once a week’, iii) ‘Yes, but less often than  
14 once a week’ and iv) ‘No, not at all’, followed by asking “Have you smoked at least 100  
15 cigarettes or a similar amount of tobacco in your life” (yes/no/not sure). Those who reported  
16 to smoke daily, or who reported to smoke occasionally as well as having smoked at least 100  
17 cigarettes in their life were classified as current smokers. Once smoking status was assessed  
18 non-smokers exited from the survey.  
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26 \*\*\*Figure 1 about here\*\*\*  
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### 30 **Presentation of experimental conditions**

31 The study was conducted on a Dell Latitude XT3 (2.50 GHz processor) touchscreen  
32 computer, using Digivey version 4 software.[27] Participants were randomly allocated to one  
33 of four cigarette pack conditions by Digivey’s randomise function, which uses a pseudo  
34 random number generator provided by the underlying programming language (see:  
35 [http://msdn.microsoft.com/en-us/library/system.random\(v=vs.90\).aspx](http://msdn.microsoft.com/en-us/library/system.random(v=vs.90).aspx)). Branded pack  
36 conditions replicated cigarette packs available for purchase at the time of survey; plain pack  
37 conditions tested the new plain packaging design, combining plain packaging stripped of  
38 branding elements with larger HWLs. The four pack conditions were: a) Branded Winfield  
39 Blue 25; b) Plain Winfield Blue 25; c) Branded B&H Smooth 25, and; d) Plain B&H Smooth  
40 25, see Figure 1. Within each pack condition, respondents were presented with a standard set  
41 of items to rate their assigned pack. All pack conditions featured the same graphic image and  
42 text HWL: ‘Smoking causes peripheral vascular disease’ that first appeared on Australian  
43 cigarette packs in 2006. The brands used were two of the most popular brand variants in the  
44 Australian mainstream: (Winfield (Blue 25)) and premium (B&H (Smooth 25)) cigarette  
45 markets. [28] Plain pack digital images were created using specifications outlined in the  
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3 Australian Government's *Tobacco Plain Packaging Act 2011*, while images of branded packs  
4 were supplied by the Centre for Behavioural Research in Cancer, Victoria, Australia.  
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## 7 8 **Outcome measures**

### 9 Brand appeal

10 While viewing the assigned pack image, respondents were asked to rate packs on various  
11 pack, smoker and taste characteristic statements, see Table 1. These items were developed by  
12 Wakefield and colleagues[19-21] based on past tobacco industry packaging studies used to  
13 assess pack attractiveness, brand imagery characteristics and perceived sensory attributes.  
14 Among adult smokers, these items have variably been used as: individual outcome items;[19]  
15 or combined to form four outcome scales and one individual item with inter-item reliability  
16 statistics presented.[20]  
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24 Brand appeal rating items were combined to form four scales and one stand-alone item in  
25 order to replicate the outcome measure structure of Wakefield *et al.*'s previous plain  
26 packaging study.[20] The outcome measures were: (1) positive pack characteristics - 'popular  
27 among smokers'; 'attractive'; 'sophisticated'; 'a brand you might try/smoke'; (2) positive  
28 smoker characteristics – 'trendy' and 'successful'; (3) negative smoker characteristic –  
29 'boring'; (4) positive taste characteristics – 'enjoyable to smoke' and 'satisfying in taste'; and  
30 (5) negative harm characteristics – 'high in tar and nicotine' and 'harmful to your health'.  
31 Although these measures have shown strong to moderate internal consistency on Cronbach's  
32 alpha previously,[20] they have not been tested in the current population, thus we undertook  
33 Cronbach's alpha assessment on scales with more than one item.  
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36 Scale reliability assessments revealed the outcome measures had moderate to strong internal  
37 consistency: positive pack characteristics ( $\alpha = .83$ ); positive smoker characteristics ( $\alpha = .71$ );  
38 positive taste ( $\alpha = .84$ ), and; negative harm characteristics ( $\alpha = .65$ ).  
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49 \*\*\*Table 1 about here\*\*\*

### 50 51 52 53 54 Purchase intentions

55 Participants were presented with images of the two brand name options (Winfield and B&H)  
56 on a single screen and asked: "If you ran out of cigarettes and only the packs below were  
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3 available in the store you went to, which would you be most tempted to buy?" Participants  
4 could choose between the two brand name images or select 'I would not buy any'.  
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6 Participants who had previously viewed and rated a plain packaging image (i.e. Pack B or D;  
7 see Figure 1) received plain image response options, and those who had previously rated a  
8 branded packaging image (i.e. Pack A or C) received branded image response options at this  
9 question.  
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### 13 14 15 Socio-demographic variables

16 Gender, age, income, income source, Aboriginal or Torres Strait Islander status, marital  
17 status, highest level of education and housing type were assessed.  
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### 20 21 22 **Statistical Analyses**

23 Analyses were conducted using Stata v11 ([www.stata.com](http://www.stata.com)). Characteristics of participants  
24 are presented by intervention group to assess the success of the randomisation.  
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### 27 28 **Instrument evaluation**

#### 29 30 31 Outcome measure assessment

32 As the outcome variables were not normally distributed we used non-parametric methods for  
33 analysis. Median scores with 95% confidence intervals are presented graphically for each of  
34 the four pack conditions. Exploratory data analysis indicated that there may be a potential  
35 pack type by brand name interaction, i.e. the relationship between packaging types (branded  
36 versus plain packaging) differed for the two different cigarette brand names. As the study  
37 had limited statistical power to assess interaction effects, we did not formally test this, but  
38 undertook analysis considering the four pack conditions separately, rather than as a factorial  
39 design. The Kruskal-Wallis test was used as a global assessment of differences in factor  
40 scores among the four pack conditions. If the  $p$ -value for this test was  $<0.1$ , pairwise  
41 comparisons using the Wilcoxon rank sum test were undertaken to compare median scores  
42 between branded packaging and plain packaging for each of the two brand names. Odds ratio  
43 analyses were used to assess the effect of packaging type (branded versus plain) on purchase  
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56 Sample size for this study was determined by requirements for another trial for which  
57 participants were recruited. Post hoc power calculations demonstrated that a sample of 350  
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3 participants (approximately 85 in each of the pack type by brand name groups) would allow  
4 detection of differences in scores between branded and plain packaging (within each brand  
5 name) of approximately half a standard deviation, with 5% significance level and 90% power  
6 (to allow for some loss of power due to the use of non-parametric analyses).  
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## 10 11 RESULTS

### 12 Sample

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14 A total of 787 clients were approached by SCSO staff during the study period and 608 were  
15 eligible to be approached to participate by the RA. Of those, 581 (96%) completed the survey  
16 and 362 (62%) of these were identified as current smokers (daily and occasional). Eight  
17 smokers were excluded as they primarily used something other than manufactured or roll-  
18 your-own tobacco. The demographic details of the study participants in each intervention  
19 group are presented in Table 2. The majority of the sample had not finished high school  
20 (64%), earned less than AUD\$300/week (55%) and received their income from Government  
21 benefit payments (95%). Socio-demographic characteristics were similar across the four  
22 intervention groups.  
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32 \*\*\*Table 2 about here\*\*\*  
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### 36 Brand Appeal Ratings

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38 ~~Scale reliability assessments revealed the outcome measures had moderate to strong internal~~  
39 ~~consistency: positive pack characteristics ( $\alpha = .83$ ); positive smoker characteristics ( $\alpha = .71$ );~~  
40 ~~positive taste ( $\alpha = .84$ ), and; negative harm characteristics ( $\alpha = .65$ ).~~  
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45 \*\*\*Figure 2 about here\*\*\*  
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48 Figure 2 displays ratings across the four pack conditions on the positive pack (2a), positive  
49 smoker (2b), negative smoker (2c), positive taste (2d), and negative harm (2e) response  
50 scales. The positive pack scale varied significantly across the pack conditions ( $p = 0.001$ ),  
51 with pairwise comparisons revealing that branded packaging images were rated significantly  
52 more positively than plain packaging images in the Winfield condition ( $p < 0.001$ ), however  
53 there was no difference in the B&H condition ( $p = 0.102$ ), see Table 3. Positive smoker  
54 characteristic ratings were significantly different across the four pack conditions ( $p = 0.003$ );  
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3 branded packaging images were rated more positively than plain packaging images within the  
4 Winfield condition ( $p = 0.001$ ), but not the B&H brand name condition ( $p = 0.197$ ), see Table  
5 3. There was no difference in the negative smoker characteristic ratings across the four pack  
6 conditions ( $p = 0.427$ ). The four pack conditions were rated significantly differently when  
7 assessing positive taste characteristics ( $p = 0.033$ ). Pairwise comparisons revealed plain  
8 packaging images were less appealing on taste attributes than branded packaging images for  
9 the Winfield condition ( $p = 0.004$ ), however there were no differences detected in taste  
10 ratings between plain and branded packaging images in the B&H condition. The four pack  
11 conditions rated similarly in regards to negative harm characteristics ( $p = 0.411$ ) as shown in  
12 Figure 2e and Table 3.  
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21 \*\*\*Table 3 about here\*\*\*  
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### 25 **Purchase Intent**

26 Participants were asked to choose which pack, if any, they would prefer to purchase out of  
27 the two brand names used in this study. Participants who viewed plain packaging images only  
28 were more likely to select that they would not buy any of the presented options (35%),  
29 compared to those who viewed branded packaging images (19%) [OR = 2.2, 95%CI = 1.3,  
30 3.5;  $p = 0.002$ ].  
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### 36 **DISCUSSION**

37 This study found that plain cigarette packs were rated as significantly less appealing than  
38 branded packs in a sample of socioeconomically disadvantaged smokers. Branded packaging  
39 was viewed as more appealing, smokers of these packs were rated in a more positive way,  
40 and the cigarette taste was preferred compared to cigarettes in plain packaging. No  
41 differences between branded and plain packaging relating to negative smoker or negative  
42 harm characteristics were detected. Finally, plain packaging reduced cigarette purchase  
43 intentions in comparison to branded packaging among smokers. The overall results of this  
44 study are supportive of previous plain packaging simulation research conducted with general  
45 population samples suggesting that plain packs are viewed less favourably on measures of  
46 brand appeal than branded packs.[19, 20]  
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3 One ~~notable unexpected~~ finding of this research, demonstrating the importance of branding in  
4 the tobacco market, was a possible interaction effect between packaging type (branded versus  
5 plain) and brand name (Winfield versus B&H). Plain pack images were rated consistently  
6 lower than branded images on measures of positive pack, positive smoker and positive taste  
7 appeal for the Winfield condition, but no differences were detected for the B&H condition.  
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9 ~~This sample of smokers may have less experience with the B&H brand, positioned as a~~  
10 ~~'premium' brand in Australia with a higher recommended retail price than the Winfield~~  
11 ~~brand, which is considered a 'mainstream' brand offering value for money~~ It might be  
12 expected that plain packaging of B&H cigarettes is unlikely to have much effect among  
13 socially disadvantaged smokers as this brand is positioned as a premium product at a high  
14 price point,[29] with apparent low penetration among this smoker group: While 19% of the  
15 sample reported regularly using the Winfield brand only 1.6% of participants reported  
16 regularly using B&H cigarettes, compared to ~~19% and 9%, respectively~~, in the general  
17 population.[28] Comparatively, engagement with the 'mainstream', value-for-money  
18 Winfield brand is much higher among socially disadvantaged smokers: participants reported  
19 regularly using this brand at the same rate as the general population (19%).[28] ~~It could be~~  
20 ~~interpreted that the effect of p~~ Plain packaging may be has the potential to show stronger  
21 effects for brands that are personally relevant ~~brands, or brands within market segmentations~~  
22 ~~relevant~~ to the individual smoker.

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36 Similarly to Wakefield *et al.*'s previous simulation studies, this study found no difference  
37 between plain and branded cigarette packaging on negative harm ratings. This may indicate  
38 that the removal of branding elements such as colours, logos, and fonts on packs is more  
39 effective in reducing brand appeal associations rather than tapping into negative harm  
40 perceptions. It is also likely that the measures used in this study, intended to assess brand  
41 appeal, were not adequate to assess negative harm perceptions related to packaging. It may  
42 also be the case that effects on perceived harm are stronger among youth compared to adults,  
43 as previous ~~There are, however, other~~ simulation studies ~~that~~ indicate plain packaging reduces  
44 false beliefs about smoking among adolescents[14] and increases cessation intentions among  
45 young adults. [8] Our study also found that the presentation of plain packaging, compared to  
46 branded packaging, reduced purchase intentions among socioeconomically disadvantaged  
47 smokers, consistent with previous simulations conducted with general population  
48 smokers. [20, 22]

### Implications

The results of this study support the move toward plain packaging policies for cigarettes. Most research used in the development of plain packaging policies was conducted with general population samples, with limited data to indicate how socioeconomically disadvantaged groups, who have among the highest smoking rates, may respond to this tobacco control policy. The current study indicates that socioeconomically disadvantaged smokers are likely to respond similarly to the general population, with plain packaging reducing brand appeal ratings and purchase intentions among these smokers. Further research, particularly in low-income countries could provide insight about the possibility of disseminating this policy internationally.

Early research in Australia indicates plain packaging makes tobacco less appealing and increases the urgency to quit smoking,[24] however it will be important to monitor impact over time. Plain packaging policies have the potential to reduce smoking initiation. Associations with brand identity and appeal are motivating factors in smoking uptake among youth.[30, 31] There are documented cases of cigarette rebranding, for example the development of the Camel 'Smooth Character', to appeal to young adult smokers with the explicit intentions of increasing market share and prevalence of smoking among youth.[32] Plain packaging policies prevent this kind of brand targeting and have the potential to reduce uptake among youth by reducing brand appeal and purchase intentions. It will also be important to assess the use of any avoidance strategies, such as pack stickers and cigarette cases, and to monitor whether these are temporary solutions, or whether on-going changes to policy are required.

### Strengths and Limitations

The primary limitation of the study is its reliance on a convenience sample limiting its external validity and generalizability. However, socially disadvantaged groups are notoriously difficult to recruit and retain in health research.[33, 34] Recruitment challenges were overcome by accessing community services as recruitment sites and using convenience samples. As a result, this study is the first to obtain a large sample of socially disadvantaged smokers' responses to a simulation of a one-off exposure to an important tobacco control policy development. Since the policy has been implemented, socially disadvantaged smokers' day-to-day experience is one of being exposed to these plain packs multiple times a day, and so the findings from this study may underestimate the real world effects of this change. This

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3 study was also limited by the measurement of purchase intentions rather than actual  
4 behaviour, the use of only two cigarette brands for comparison. Use of a wider range of  
5 brands for comparison is recommended for research in countries considering implementing  
6 plain packaging. Although the study employed a computer image instead of actual packs,  
7 previous packaging research demonstrates results are generally consistent regardless of  
8 stimulus presentation modality.[22, 35, 36] The outcome measures used in this study pose an  
9 additional limitation. Although they were selected for the purpose of comparing results with  
10 previous plain pack research,[19, 20] they have not been evaluated for validity or reliability  
11 and this should be assessed in the future.

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20 As this study tested the Australian Government's new plain pack design, which combines  
21 plain packaging with larger HWLs, we were unable to distinguish which factor (plain  
22 packaging or larger HWLs) produced the observed results. Previously, Wakefield *et al.*[20]  
23 examined the importance of branding versus HWL size on cigarette packaging, concluding  
24 that plain packaging reduced elements of brand appeal far more than increasing the size of  
25 HWLs. In their study, when packs were plain, increasing the size of HWLs above 30% did  
26 not reduce brand appeal further. This finding suggests that the effects observed in the current  
27 study are more likely due to stripping the pack of branding elements, than increasing the  
28 HWL size. Finally, the last 2 – 3 months of survey occurred during the policy roll-out phase  
29 and participants may have already been exposed to and purchased plain packs. Prior exposure  
30 may have allowed participants to become familiar with the new pack designs, and may  
31 explain why participants did not rate packs differently on negative harm and smoker  
32 measures.

### 33 34 35 36 37 38 39 40 41 42 **Conclusions**

43  
44 The findings of this study support plain packaging policy, and show this strategy has the  
45 potential to reduce positive associations with cigarette packs among a group of highly  
46 socioeconomically disadvantaged smokers. It will be important to monitor the long-term  
47 outcomes of plain packaging policy, particularly with regards to uptake of smoking in  
48 disadvantaged groups. Further plain pack research in low-income countries is recommended,  
49 to support the potential dissemination of the policy internationally.  
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**COMPETING INTERESTS**

None to declare.

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**ETHICS APPROVAL**

University of Newcastle's Human Research Ethics Committee.

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**Table 1.** Standard items used to assess responses to pack images.

Survey items	Response scale
<b>Pack characteristics:</b> <i>How well do you think the following phrases relate to the cigarette pack shown?</i>	<del>Visual analogue</del> <u>Response</u> scale: 1 (not at all) to 7 (extremely)
This pack is popular among smokers	
This pack is attractive	
This pack is sophisticated	
This pack is a brand you might try/smoke	
<b>Smoker characteristics:</b> <i>How well do you think the following characteristics describe a typical smoker of the pack shown?</i>	<del>Visual analogue</del> <u>Response</u> scale: 1 (not at all) to 7 (extremely)
A typical smoker of this pack is trendy	
A typical smoker of this pack is boring	
A typical smoker of this pack is successful	
<b>Taste attributes:</b> <i>Please rate the following phrases describing the taste of cigarettes from the pack shown.</i>	<del>Visual analogue</del> <u>Response</u> scale: 1 (not at all) to 7 (extremely)
I would expect the cigarettes in this pack to be enjoyable to smoke	
I would expect the cigarettes in this pack to be high in tar and nicotine	
I would expect the cigarettes in this pack to be satisfying in taste	
I would expect the cigarettes in this pack to be harmful to your health	



**Table 2.** Demographic characteristics of the survey sample ( $N = 354$ ).

Characteristic	Winfield	Winfield	B&H	B&H	Total
	Branded	Plain	Branded	Plain	
	N (%)	N (%)	N (%)	N (%)	N (%)
<i>N</i>	92 (26)	95 (27)	88 (25)	79 (22)	354
<b>Age</b>					
18 – 39	56 (61)	51 (54)	51 (58)	48 (61)	206 (58)
40+	36 (39)	44 (46)	37 (42)	31 (39)	148 (42)
<b>Gender</b>					
Female	61 (66)	46 (52)	66 (70)	43 (54)	216 (61)
<b>Aboriginal and/or Torres Strait Islander</b>					
Yes	23 (25)	14 (16)	17 (18)	10 (13)	64 (18)
<b>Marital Status</b>					
Married / De facto / Living with partner	29 (32)	15 (17)	23 (24)	20 (25)	87 (25)
Separated / Divorced	27 (29)	29 (33)	27 (28)	20 (25)	103 (29)
Never married / Single / Widowed	36 (39)	44 (50)	45 (47)	39 (49)	164 (46)
<b>Highest Education</b>					
Primary school	0 (0)	4 (5)	4 (4)	4 (5)	12 (3.4)
High school years 7-10	62 (67)	54 (61)	59 (62)	39 (49)	214 (61)
High school years 11-12	11 (12)	13 (15)	13 (14)	14 (18)	51 (14)
TAFE / trade qualification	14 (16)	13 (15)	16 (17)	21 (27)	64 (18)
University degree	5 (5)	4 (5)	3 (3)	1 (1)	13 (3.7)
<b>Personal Weekly Income</b>					
<\$299	54 (59)	55 (58)	48 (56)	38 (48)	195 (55)
>\$300	36 (39)	33 (35)	31 (35)	37 (47)	137 (39)
Prefer not to answer	2 (2)	7 (7)	9 (10)	4 (5)	22 (6)
<b>Income source</b>					
Paid work	6 (7)	2 (2)	4 (4)	1 (1)	13 (3.7)
Government payment (Centrelink)	85 (92)	85 (97)	89 (94)	76 (96)	335 (95)
Other	1 (1)	1 (1)	2 (2)	2 (3)	6 (1.7)
<b>Housing type</b>					
Own house/private rental	26 (28)	31 (33)	28 (32)	23 (29)	108 (31)
Government rental	55 (60)	42 (44)	44 (50)	43 (54)	184 (52)
Homeless/Supported accommodation	11 (12)	22 (23)	16 (18)	13 (17)	62 (18)
<b>Regular cigarette brand</b>					
Winfield	10 (17)	16 (21)	14 (24)	10 (18)	50 (20)
Benson & Hedges	1 (1.7)	1 (1.3)	2 (3.5)	0 (0)	4 (1.6)
Other	36 (62)	50 (65)	34 (59)	36 (66)	156 (63)
I don't have a regular brand	11 (19)	10 (13)	8 (14)	9 (16)	38 (15)
<b>Regular tobacco type</b>					
Manufactured cigarettes	58 (63)	77 (81)	58 (66)	55 (70)	248 (70)
Roll-your-own tobacco	34 (37)	18 (19)	30 (34)	24 (30)	106 (30)

**Table 3.** Effect of pack condition on brand appeal ratings ( $N = 354$ ).

	<i>Pack Condition</i>				<i>Global test</i>	<i>Pairwise</i>	
	<i>Winfield_Branded</i>	<i>Winfield_Plain</i>	<i>B&amp;H_Branded</i>	<i>B&amp;H_Plain</i>		<i>Winfield (branded v plain)</i>	<i>Benson&amp;Hedges (branded v plain)</i>
	<i>(n = 92)</i>	<i>(n = 95)</i>	<i>(n = 88)</i>	<i>(n = 79)</i>	<i>P</i>	<i>P</i>	<i>P</i>
	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>	<i>Median (95%CI)</i>			
Positive pack	3.86 (3.5 – 4.25)	2.25 (2 – 2.5)	2.63 (2.07 – 3.25)	2.5 (1.75 – 2.75)	<0.001	<0.001	0.102
Positive smoker	2.5 (2 – 3.5)	1 (1 – 2)	2.5 (2 – 3)	2.5 (1.5 – 2.87)	0.003	0.001	0.197
Negative smoker (boring)	2 (1 – 3)	2 (1 – 2)	2 (1 – 3)	3 (1.27 – 3.73)	0.427	n/a	n/a
Positive taste	4 (3.5 – 4.5)	3 (2.11 – 3.5)	3.75 (3 – 4)	3 (2 – 4)	0.033	0.004	0.804
Negative harm	5.5 (4.55 – 6)	5.5 (4.5 – 6)	4.5 (4 – 5.5)	6 (5.14 – 6.5)	0.411	n/a	n/a

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Original Branded Packaging



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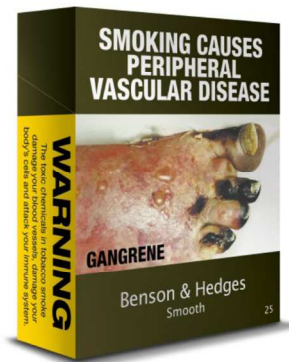
Plain Packaging



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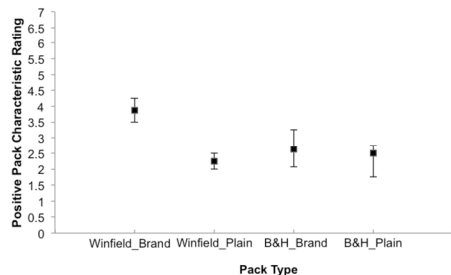


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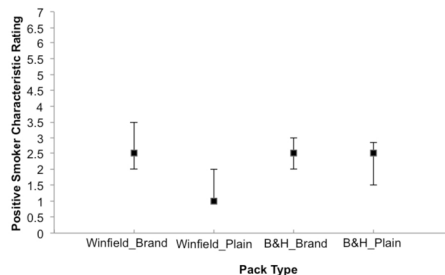
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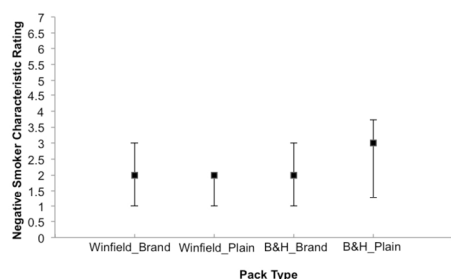
a) Positive Pack Characteristic Response Scale



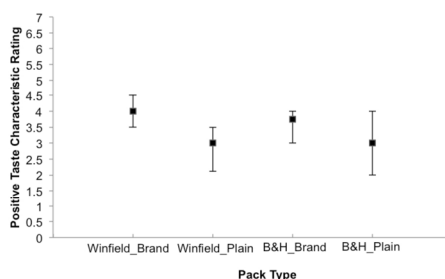
b) Positive Smoker Characteristic Response Scale



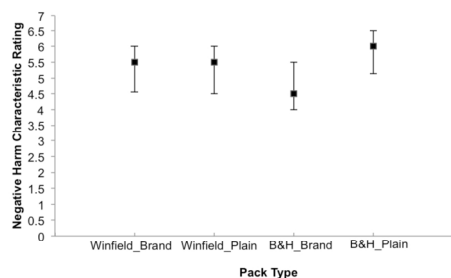
c) Negative Smoker Characteristic Response Scale



d) Positive Taste Characteristic Response Scale



e) Negative Harm Characteristic Response Scale



\*B&H refers to the Benson & Hedges brand name condition.

Figure 2. Median ratings with 95%CI for each response scale by pack condition (N = 354).  
173x212mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Yes
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Yes
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Yes
Objectives	3	State specific objectives, including any prespecified hypotheses	Yes
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Yes
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Yes
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Yes
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Yes
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Yes
Bias	9	Describe any efforts to address potential sources of bias	Yes
Study size	10	Explain how the study size was arrived at	Yes
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Yes
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Yes
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	NA
		(d) If applicable, describe analytical methods taking account of sampling strategy	NA
		(e) Describe any sensitivity analyses	NA
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Yes
		(b) Give reasons for non-participation at each stage	Yes
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Yes
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Yes
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA
		(b) Report category boundaries when continuous variables were categorized	NA
		(c) If relevant, consider translating estimates of relative risk into absolute risk for	NA

a meaningful time period

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Yes
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Yes
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Yes
Generalisability	21	Discuss the generalisability (external validity) of the study results	Yes
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Yes

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).