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Changes in use of types of tobacco products by pack sizes and price segments, prices paid and consumption following the introduction of plain packaging in Australia

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ABSTRACT

Objectives To describe changes among smokers in use of various types of tobacco products, reported prices paid and cigarette consumption following the standardisation of tobacco packaging in Australia.

Methods National cross-sectional telephone surveys of adult smokers were conducted from April 2012 (6 months before transition to plain packaging (PP)) to March 2014 (15 months afterwards). Multivariable logistic regression assessed changes in products, brands and pack types/sizes; multivariable linear regression examined changes in inflation-adjusted prices paid and reported cigarette consumption between the pre-PP and three subsequent periods—the transition phase, PP year 1 and PP post-tax (post a 12.5% tax increase in December 2013).

Results The proportion of current smokers using roll-your-own (RYO) products fluctuated over the study period. Proportions using value brands of factory-made (FM) cigarettes increased from pre-PP (21.4%) to PP year 1 (25.5%; $p=0.002$) and PP post-tax (27.8%; $p<0.001$). Inflation-adjusted prices paid increased in the PP year 1 and PP post-tax phases; the largest increases were among premium FM brands, the smallest among value brands. Consumption did not change in PP year 1 among daily, regular or current smokers or among smokers of brands in any market segment. Consumption among regular smokers declined significantly in PP post-tax (mean=14.0, SE=0.33) compared to PP year 1 (mean=14.8, SE=0.17; $p=0.037$).

Conclusions Introduction of PP was associated with an increase in use of value brands, likely due to increased numbers available and smaller increases in prices for value relative to premium brands. Reported consumption declined following the December 2013 tax increase.

INTRODUCTION

The tobacco market in Australia includes factory-made (FM) cigarettes, cigars and smoking tobacco (some brands for use in pipes and some brands for use in roll-your-own (RYO) cigarettes).¹ It differs from some other markets internationally in that smokeless tobacco for oral use, while legal to import, cannot be sold.² Similarly e-cigarettes may be sold, but nicotine capsules for use in such devices can currently only be imported under particular arrangements.³ Use of RYO is less common than in neighbouring New Zealand and in the UK or Canada.⁴ FM cigarettes dominate and almost all cigarettes are filtered. Menthol cigarettes make up

less than 10% of the market in Australia.⁵ While a small number of slims and king size brands are available, most cigarettes sold are regular size.¹ Cigarette brands in Australia until 2006 were typically sold in four different 'tar' levels—16, 12, 8 and 4 mg, with 2 mg also available in some brands.⁶ In 2006 the three major manufacturers stopped using such labelling,⁷ however, colour coding and terms such as Rich, Smooth and Ultra were incorporated into pack design and in variant names providing consumers with cues about concordance with the old tar-levels.⁸

As in most countries, cigarettes in Australia have been categorised into three price segments—premium, mainstream and value.^{5,9} The recommended retail price per typical pack of 25s in early-2014 was over \$20 for premium brands and under \$17.70 for value brands.⁵ While value brands have traditionally been sold in Australia in packs of 35, 40 and 50 cigarettes¹⁰ many value brands have recently become available in packs of 20 which retail well under the \$15 mark,¹¹ and some commentators have pointed to the emergence of a super-value segment.¹² A full list of products available for sale in Australia between 2012 and 2014 can be viewed here (see online supplementary table S1).

Prices charged at the retail level in small mixed businesses and petrol stations are generally in line with recommended retail prices regularly published by Australia's association of retail tobacconists,¹³ however, larger retailers such as supermarkets and large tobacconists often negotiate lower wholesale prices for greater volumes and sell tobacco products at prices discounted well below the recommended levels.¹⁴ A recent check of prices in supermarkets (May 2014) revealed prices approximately 2–7% cheaper for premium brands, 5–15% cheaper for mainstream brands and 3–16% cheaper for value brands.¹⁵ Thus, the price paid by a consumer for a pack of cigarettes may vary considerably not just based on price segment of the brand they choose (value, mainstream or premium), but also depending on whether they purchase it from a convenience or a discount outlet, as a single pack, a multipack (two or three packs bundled together) or carton, and what pack size they purchase.

This paper aims to assess the impact on product choice, prices paid and consumption following changes in the packaging of tobacco products introduced by the Australian Government at the end of 2012, the details of which are set out in a



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companion paper in this supplement.¹⁶ Choice of product type, purchase channel and pack size and prices paid may affect consumption patterns^{17 18} as well as quitting behaviours^{19–21} so it was important to track all of these behaviours. Shifts in purchasing decisions and reductions in consumption could occur after the introduction of plain packaging (PP) with larger and refreshed graphic health warnings. Smokers could attempt to ameliorate the effects of the new, concern-provoking packaging by smoking fewer cigarettes, rather than trying to quit. On the other hand, the tobacco industry has argued that PP would result in a fall in overall prices in the market as companies would be forced to compete on price alone and that this would lead to a shift to value brands and illicit tobacco, and an overall increase in consumption.^{22–24}

This paper aims to test predictions by the tobacco industry that the legislation would result in

1. a decline in the use of premium and mainstream brands and an increase in use of value brands
2. a decline in prices paid for tobacco products, particularly for premium brands and
3. a consequent increase in the consumption of tobacco products.

These predictions were vigorously promulgated in response to the Government's calls for comment on draft legislation.^{22–24} Claims that sales of tobacco products have increased since implementation have continued to be made in the media,^{25 26} in submissions to UK government inquiries considering proposals to implement standardised packaging^{27–30} and in New Zealand.³¹ Another key prediction—that use of illicit tobacco would increase—is tested elsewhere (this volume).³²

When attempting to assess the impact of PP legislation on consumers' choice of tobacco product type, prices paid and number of cigarettes consumed, account must also be taken of the effects of other government policies and industry strategies that attempt to mitigate the effects of such policies.^{33 34} The introduction of PP coincided with numerous instances of tobacco companies expanding variant names to reinforce the colour system of naming,³⁵ with *Pall Mall Slims* variant names Red, Blue, Amber and Green, for instance, changing to Original Red, Rich Blue, Smooth Amber and Menthol Green.^{13 35} Manufacturers also took the opportunity to reformulate product and pack size offerings and adjust recommended retail prices. As detailed elsewhere³⁵ product reformulations included the extension of several brands to include king size cigarettes with extralong filters (eg, *Pall Mall Extra Kings* 20s) and the insertion of padding in the packaging of slim cigarettes in order to comply with required larger pack size dimensions without increasing the diameter of the cigarettes (for *Vogue Slims* 20s). Several new and novel menthol products—featuring either or both loading with extra menthol (eg, *Holiday Cool Chill*, *Cool Frost* and *Cool Blast*), or squeezable capsules in the filter to convert the cigarette to menthol (eg, *Peter Jackson Hybrid*)—were introduced onto the market before PP.³⁵ This paper also assesses whether use of these products increased given that opportunities to promote product characteristics through package design were curtailed after the introduction of PP legislation.

Australia is unusual internationally in that excise/customs duty since 1986 has been automatically inflation-adjusted 6-monthly resulting in twice yearly increases in retail prices since that time.¹⁰ Increases in excise/customs duty most commonly have been 'over-shifted' to consumers (ie, increases have been higher than that required merely to pass on the effects of indexation),¹⁰ and Scollo *et al*³⁶ have reported in this volume that

recommended retail prices increased more steeply among premium than among value brands over the period of introduction of PP. A further aim of this study was to assess whether a similar pattern of increases was observed for prices paid by consumers taking into account not just recommended prices but prices charged, and changes in use of brands within segments.

After a 25% increase in tobacco excise/customs duty in Australia in April 2010 (on top of the earlier 20–25% increase in duty applicable to large packs in November 1999 and continuing increases with twice-yearly indexation since that time), value brands in traditionally large pack sizes in Australia had been becoming increasingly less affordable for price-sensitive smokers.¹⁰ While still cheaper per stick than many other brands, the up-front cost of a pack of *Horizon* 50s (the leading value brand in 2011) had increased from \$15.42 (AUD) in February 2001 to \$29.80 in February 2012, just under \$30, no doubt a critical 'left-digit price point'.^{37 38} Tobacco companies needed to find a way to provide value smokers with products with lower up-front costs. In the lead up to PP, several new value brands were introduced in small pack sizes early in 2012³⁵ and several brands of FM cigarettes already sold in 20s were expanded to include packs of 21, 22 and 23.³⁵ Some changes in pack size offerings effectively provided 'free' cigarettes, with the recommended retail prices for packs of 21s and 22s, for example, being listed at the same or lower price as packs of 20s.³⁹ In addition, several brands appeared in a pack size of 26, and packs of 35s were replaced with 30s. Several brands traditionally offered in packs of 50 cigarettes introduced 40s or priced existing 40s products more competitively than 50s.³⁶ Online supplementary table S2 shows the variant-pack size combinations available for *John Player Special (JPS)* which manufacturer Imperial Tobacco reports was the fastest growing brand over 2013.^{40 41} As indicated in table 1 in Scollo *et al*³⁶ in this volume, between November 2011 and November 2013, the number of brands available in new pack sizes increased from 0 to 2 for 21s, from 0 to 1 for 22s, from 0 to 2 for 23s, from 0 to 3 for 26s. The expansion of pack sizes observed across the market was likely intended to retain price sensitive smokers including those wanting to buy value cigarettes, but likely to balk at the very high up-front purchase cost of a pack of 50s. A further aim of this study therefore was to document any changes in the distribution of use of different pack sizes in Australia.

During the course of the current study, the Australian Government announced that it would introduce four 12.5% increases in excise/customs duty, the first in December 2013,⁴² and the other three scheduled to occur annually from September 2014.^{16 43 44} To prevent increases in the affordability of tobacco products in the longer term, the legislation enacting these increases also amended the basis for 6-monthly indexation so that from March 2014, indexation in line with the consumer price index (CPI) would cease and tobacco excise and customs duty would be indexed instead in line with changes in Average Weekly Earnings.^{43 44} Reducing affordability through tax increases is a highly effective approach available to governments to reduce the use of tobacco products.^{45–47} Two final aims of this study were to assess changes in reported prices paid and changes in reported numbers of cigarettes consumed in the period up to and after the large increase in excise duty on 1 December 2013.

METHODS

Design

National cross-sectional telephone surveys were conducted between 9 April 2012 and 30 March 2014, with approximately

Table 1 Type of cigarette smoked, market segment of current cigarette smokers' current brands of FM and RYO cigarettes, and features of FM cigarettes by phase: percentages and results of logistic regression models

Time period	Differences between PP phases—unadjusted models			Differences between PP phases—adjusted models		
	Per cent	OR	95% CI	Per cent	OR	95% CI
Type of cigarette smoked (n=8610)†						
Any FM						
Pre-PP	79.6	1.00		79.5	1.00	
Transition	83.1	1.26	1.00 to 1.59	83.2	1.28*	1.02 to 1.62
PP year 1	80.8	1.08	0.93 to 1.24	81.0	1.10	0.96 to 1.28
PP post-tax	78.8	0.95	0.79 to 1.15	79.2	0.98	0.81 to 1.19
Any RYO						
Pre-PP	32.8	1.00		32.9	1.00	
Transition	27.0	0.76**	0.62 to 0.92	26.7	0.73**	0.60 to 0.90
PP year 1	33.6	1.04	0.92 to 1.17	33.4	1.02	0.90 to 1.16
PP post-tax	32.0	0.96	0.82 to 1.13	31.4	0.93	0.79 to 1.10
Both FM and RYO						
Pre-PP	13.9	1.00		13.8	1.00	
Transition	11.7	0.82	0.62 to 1.09	11.5	0.81	0.60 to 1.08
PP year 1	15.9	1.17	0.99 to 1.38	15.9	1.19*	1.00 to 1.41
PP post-tax	12.9	0.92	0.73 to 1.16	12.8	0.92	0.72 to 1.17
Market segment (n=7076)‡						
RYO tobacco						
Pre-PP	22.7	1.00		22.9	1.00	
Transition	17.8	0.74*	0.57 to 0.95	17.6	0.71*	0.55 to 0.93
PP year 1	21.4	0.93	0.80 to 1.08	21.3	0.91	0.78 to 1.06
PP post-tax	21.3	0.92	0.75 to 1.13	21.7	0.93	0.75 to 1.15
Value FM cigarettes						
Pre-PP	21.1	1.00		21.4	1.00	
Transition	22.2	1.07	0.84 to 1.35	22.1	1.04	0.82 to 1.33
PP year 1	25.8	1.30**	1.12 to 1.50	25.5	1.27**	1.10 to 1.48
PP post-tax	27.4	1.41**	1.16 to 1.71	27.8	1.44***	1.18 to 1.76
Mainstream FM cigarettes						
Pre-PP	39.2	1.00		39.1	1.00	
Transition	42.7	1.16	0.94 to 1.42	42.9	1.17	0.96 to 1.44
PP year 1	37.4	0.92	0.81 to 1.05	37.4	0.93	0.82 to 1.06
PP post-tax	36.2	0.88	0.74 to 1.05	36.1	0.88	0.73 to 1.05
Premium FM cigarettes						
Pre-PP	16.9	1.00		16.5	1.00	
Transition	17.3	1.03	0.79 to 1.33	17.7	1.09	0.83 to 1.43
PP year 1	15.4	0.90	0.76 to 1.05	15.7	0.93	0.79 to 1.11
PP post-tax	15.1	0.88	0.70 to 1.09	14.5	0.85	0.68 to 1.07
FM cigarette features (n=4824)§						
Menthol						
Pre-PP	11.0	1.00		11.1	1.00	
Transition	10.9	0.99	0.69 to 1.42	11.3	1.02	0.70 to 1.47
PP year 1	10.9	0.98	0.78 to 1.24	11.0	0.99	0.78 to 1.25
PP post-tax	11.3	1.03	0.76 to 1.39	10.9	0.98	0.71 to 1.34
Cigarette length—king size						
Pre-PP	2.2	1.00		2.2	1.00	
Transition	1.1	0.52	0.21 to 1.24	1.2	0.52	0.21 to 1.25
PP year 1	2.0	0.91	0.56 to 1.47	2.0	0.90	0.55 to 1.45
PP post-tax	2.4	1.10	0.58 to 2.10	2.4	1.09	0.57 to 2.09
Cigarette diameter—slims						
Pre-PP	0.8	1.00		0.7	1.00	
Transition	1.4	1.77	0.62 to 5.06	1.4	1.86	0.65 to 5.31
PP year 1	1.8	2.30*	1.12 to 4.72	1.8	2.39*	1.16 to 4.94
PP post-tax	1.3	1.65	0.68 to 4.00	1.3	1.65	0.68 to 4.04

*p<0.05, **p<0.01, ***p<0.001.

†Of n=8811 smokers, we excluded those who did not have SES information (n=201). Analysed n=8610.

‡Of n=8679 cigarette smokers, we excluded those who: did not provide their current brand name (n=283); currently smoked unbranded tobacco or gave a brand of cigars/cigarillos or e-cigarettes (n=60); did not recall where they purchased their pack or received it as a gift (n=75); did not provide a valid pack size (n=231); did not report a price (n=413); purchased tobacco duty free or overseas (n=70); skipped relevant questions due to back-coding of verbatim responses (n=77); gave responses that were deemed unlikely to be correct (such as a non-existent pack size or unrealistically low or high price) (n=243); or did not have SES information (n=151). Analysed n=7076.

§Of n=4958 FM only cigarette smokers included in the market segment analyses, we excluded those who: did not provide their current variant name (n=42); or did not have SES information (n=92). Analysed n=4824.

FM, factory made; PP, plain packaging; RYO, roll-your-own; SES, socioeconomic status.

100 interviews completed each week. As detailed in Wakefield *et al*⁴⁸ (this volume), a dual frame design using random digit dialling to landline and mobile phones was used, with an average adjusted response rate per 4-week period of 57%.

Participants

Eligible participants were current smokers and recent (past year) quitters of tobacco products, aged 18–69 years. For the present study, we included all current smokers (n=8811) and limited the sample as appropriate for various analyses.

Measures

Tobacco products used

All current smokers were asked, “Do you currently smoke FM cigarettes only, RYO cigarettes only, both, or neither of these?” They were then asked whether they currently smoked any other form of tobacco and to list which types (ie, cigars, pipes, etc).

Market segment of current brands

Those who smoked cigarettes were asked to provide their current brand and variant names (the brand of their last cigarette smoked). We coded current brands of FM cigarettes into three market segments (value, mainstream and premium) using definitions from *Retail World*⁹ trade magazine where they existed and using stick prices relative to those for listed prices where they did not. Brands of RYO tobacco were coded as a fourth market segment.

The brand variants nominated were also classified according to whether or not they were king size, regular size or slims and whether or not the name of the brand variant suggested that the product was mentholated.

Pack types and sizes of tobacco products purchased and reported prices paid

Cigarette smokers were then asked the pack size of their current brand (in number of cigarettes or grams) and questions to ascertain pack/pouch price, including pack type for FM cigarettes (single pack, multipack containing ≤ 100 cigarettes, or carton containing > 100 cigarettes). We configured these responses into cents per cigarette (or per 0.8 g of RYO tobacco (the weight at which duty on a RYO cigarette is equivalent to that of a FM cigarette)).⁴⁹ Reported prices were then adjusted for inflation to March 2014 prices using the quarterly CPI.⁵⁰ Respondents were also asked if they had tried any other brand in the previous month because it was cheaper than usual, and how often in the past month they had thought about much they spend on smoking (many or several times vs never or once or twice).

Reported consumption

Finally, daily, weekly and monthly cigarette smokers were asked how many cigarettes they smoked per day, week or month (respectively). For analysis, these were configured into cigarettes per day.

Analysis

We used logistic and linear regression to assess changes between the pre-PP period (April to September 2012; n=2223) and three subsequent time periods: the transition phase during which plain packages were being introduced into the Australian market (October and November 2012; n=776); PP year 1 (December 2012 to November 2013; n=4431); and PP post-tax (December 2013 to March 2014; n=1381). First, we used logistic regression to assess changes among all 8811 current smokers (excluding n=201 for whom socioeconomic status (SES) could

not be determined) in odds of smoking FM cigarettes, RYO cigarettes, cigars and pipes (alone or in combination with other types of tobacco).

We then analysed features of current FM cigarette and RYO tobacco products among 7076 smokers of FM or RYO cigarettes for whom SES could be determined and who provided full information on their current brand, place of purchase, pack size and price (see notes to table 1). Logistic regression models examined change between the pre-PP and later time periods in prevalence of brand extensions/variants classified as menthol, slims and king size cigarette types. We used logistic regression to assess change between the pre-PP and later time periods in prevalence of use of brands of each market segment (RYO tobacco; value; mainstream; or premium FM cigarettes) and use of different pack types and sizes (see notes to table 2). Linear regression was used to assess whether real prices paid changed from the pre-PP period. We also tested interactions between the pre-PP and PP year 1 and the pre-PP and PP post-tax phases and market segment and pack size to determine whether prices changed more among some brands and pack sizes than others. Logistic regression was used to assess the proportion of FM and/or RYO smokers who had tried a different brand because they were cheaper or thought about money spent on smoking during past month. To assess changes in daily cigarette consumption for daily, weekly and monthly smokers, we used linear regression.

All regression models controlled for sex, age group (18–29, 30–49 and 50–69 years), area SES (computed using an index of relative disadvantage)⁵¹ and education (less than high school, high school and/or some tertiary and tertiary or higher). For analyses examining daily cigarette consumption, we also controlled for past 3-month exposure to antismoking campaigns that aired on television during the survey period, as measured by Target Audience Rating Points (TARPs) for adults aged 18 and above. TARPs represent an average potential exposure to advertising, with 100 TARPs equivalent to an average of one potential advertisement exposure per month for all adults within a media market.

Data were weighted as described in Wakefield *et al*⁴⁸ (this volume). All analyses were conducted in Stata V12.1, adjusting for the effects of sample weighting on parameter estimates and SEs. In addition, an unconditional approach (ie, the ‘subpopulation’ command in Stata V12.1) was used to limit the sample as appropriate for each set of analyses, ensuring correct estimation of the SEs. Both unadjusted and adjusted results are provided in tables; all results reported in text below are adjusted for covariates.

RESULTS

Participants

Of the 8811 current smokers, slightly more than one quarter of participants (29%) were aged 18–29 years, 45% were aged 30–49 years and 26% were aged 50–69 years; 55% were men. Additionally, 39% of smokers resided in low-SES, 42% mid-SES and 18% in high-SES areas. Overall, 31% had not completed high school, 56% had completed high school and/or had some tertiary education and 13% had completed tertiary or higher education.

Types of products used

Types of tobacco smoked—cigarettes versus cigars and pipes

Use of cigars or pipes was uncommon (cigars=2.9%; pipes=0.8%) with no difference between the pre-PP phase and any of the subsequent phases (results not in tables).

Table 2 FM pack configurations, and size of FM cigarette packs and RYO pouches of current smokers' brands by phase: percentages and results of logistic regression models

Time period	Differences between PP phases—unadjusted models			Differences between PP phases—adjusted models		
	%	OR	95% CI	%	OR	95% CI
FM pack configuration (n=5559)						
Single pack						
Pre-PP	84.3	1.00		84.2	1.00	
Transition	84.0	0.98	0.73 to 1.31	83.8	0.97	0.73 to 1.31
PP year 1	79.9	0.74**	0.61 to 0.89	80.0	0.75**	0.62 to 0.90
PP post-tax	78.3	0.67**	0.53 to 0.85	78.2	0.67**	0.52 to 0.86
Multipack						
Pre-PP	2.9	1.00		2.9	1.00	
Transition	4.9	1.69	0.96 to 2.98	4.8	1.71	0.96 to 3.02
PP year 1	6.2	2.20***	1.50 to 3.23	6.4	2.29***	1.55 to 3.39
PP post-tax	9.1	3.33***	2.15 to 5.14	9.4	3.49***	2.24 to 5.43
Carton						
Pre-PP	12.7	1.00		12.9	1.00	
Transition	11.1	0.86	0.62 to 1.19	11.3	0.85	0.61 to 1.19
PP year 1	13.9	1.10	0.90 to 1.35	13.6	1.06	0.87 to 1.31
PP post-tax	12.5	0.98	0.74 to 1.29	12.4	0.95	0.71 to 1.27
Pack/pouch size						
FM cigarettes (n=5559)						
20 cigarettes						
Pre-PP	16.9	1.00		16.8	1.00	
Transition	17.5	1.04	0.78 to 1.40	17.4	1.05	0.78 to 1.41
PP year 1	15.7	0.92	0.76 to 1.11	15.8	0.93	0.77 to 1.13
PP post-tax	19.3	1.18	0.92 to 1.51	19.2	1.19	0.92 to 1.52
21, 22 or 23 cigarettes						
Pre-PP	1.6	1.00		1.6	1.00	
Transition	1.4	0.87	0.36 to 2.13	1.4	0.84	0.34 to 2.06
PP year 1	4.0	2.52***	1.52 to 4.18	3.9	2.45**	1.48 to 4.08
PP post-tax	3.0	1.86	0.98 to 3.52	3.0	1.86	0.98 to 3.53
25 cigarettes						
Pre-PP	43.1	1.00		42.7	1.00	
Transition	46.9	1.17	0.93 to 1.46	47.0	1.20	0.95 to 1.51
PP year 1	39.4	0.86*	0.74 to 0.99	39.7	0.88	0.76 to 1.01
PP post-tax	33.9	0.68***	0.56 to 0.82	33.7	0.67***	0.55 to 0.82
26 cigarettes						
Pre-PP	0.3	1.00		0.4	1.00	
Transition	1.0	2.92	0.62 to 13.85	1.0	2.82	0.60 to 13.25
PP year 1	2.5	7.35**	2.13 to 25.41	2.5	7.20**	2.08 to 24.91
PP post-tax	3.2	9.47**	2.62 to 34.20	3.3	9.62**	2.65 to 34.92
30 or 35 cigarettes						
Pre-PP	17.4	1.00		17.5	1.00	
Transition	14.5	0.80	0.59 to 1.09	14.6	0.80	0.59 to 1.09
PP year 1	16.5	0.94	0.78 to 1.13	16.4	0.93	0.77 to 1.12
PP post-tax	15.9	0.90	0.69 to 1.16	15.9	0.89	0.69 to 1.15
40 cigarettes						
Pre-PP	13.6	1.00		13.7	1.00	
Transition	13.1	0.96	0.70 to 1.32	13.2	0.95	0.69 to 1.32
PP year 1	16.1	1.22	1.00 to 1.49	15.9	1.20	0.98 to 1.47
PP post-tax	18.6	1.46**	1.12 to 1.90	18.8	1.48**	1.13 to 1.93
50 cigarettes						
Pre-PP	7.1	1.00		7.2	1.00	
Transition	5.6	0.78	0.51 to 1.19	5.7	0.77	0.50 to 1.19
PP year 1	5.8	0.81	0.62 to 1.06	5.8	0.78	0.59 to 1.03
PP post-tax	6.1	0.85	0.59 to 1.23	6.2	0.84	0.58 to 1.23
RYO tobacco (n=1517)						
25 g						
Pre-PP	2.6	1.00		2.6	1.00	
Transition	5.4	2.11	0.66 to 6.76	5.4	2.12	0.66 to 6.82

Continued

Table 2 Continued

Time period	Differences between PP phases—unadjusted models			Differences between PP phases—adjusted models		
	%	OR	95% CI	%	OR	95% CI
PP year 1	11.6	4.88***	2.34 to 10.18	11.6	4.93***	2.36 to 10.32
PP post-tax	23.3	11.30***	5.18 to 24.67	23.2	11.36***	5.25 to 24.56
30 g						
Pre-PP	41.0	1.00		40.7	1.00	
Transition	39.0	0.92	0.57 to 1.48	39.1	0.93	0.58 to 1.52
PP year 1	36.6	0.83	0.63 to 1.10	37.1	0.86	0.65 to 1.13
PP post-tax	26.6	0.52**	0.35 to 0.78	25.7	0.50**	0.33 to 0.75
35 or 40 g						
Pre-PP	1.3	1.00		1.3	1.00	
Transition	2.2	1.77	0.29 to 10.63	2.2	1.77	0.30 to 10.34
PP year 1	0.6	0.45	0.11 to 1.90	0.6	0.44	0.10 to 1.93
PP post-tax	0.2	0.19	0.02 to 1.83	0.2	0.18	0.02 to 1.91
50 or 55 g						
Pre-PP	55.2	1.00		55.5	1.00	
Transition	53.4	0.93	0.59 to 1.49	53.3	0.91	0.57 to 1.47
PP year 1	51.2	0.85	0.65 to 1.12	50.7	0.82	0.62 to 1.08
PP post-tax	49.9	0.81	0.56 to 1.17	50.9	0.83	0.57 to 1.20

Of n=8679 cigarette smokers, we excluded those who: did not provide their current brand name (n=283); currently smoked unbranded tobacco or gave a brand of cigars/cigarillos or e-cigarettes (n=60); did not recall where they purchased their pack or received it as a gift (n=75); did not provide a valid pack size (n=231); did not report a price (n=413); purchased tobacco duty free or overseas (n=70); skipped relevant questions due to back-coding of verbatim responses (n=77); gave responses that were deemed unlikely to be correct (such as a non-existent pack size or unrealistically low or high price) (n=243); or did not have socioeconomic status information (n=151). Analysed n=7076.

*p<0.05, **p<0.01, ***p<0.001.

FM, factory made; PP, plain packaging; RYO, roll-your-own.

Types of cigarettes used—FM and/or RYO cigarettes

The proportion of all cigarette smokers reporting any use of FM cigarettes significantly increased from pre-PP to the transition phase, but returned to pre-PP levels during PP year 1 and PP post-tax phases (table 1). The proportions of current cigarette smokers reporting any use of RYO cigarettes was lower in the transition phase than pre-PP, but was similar to pre-PP during the PP year 1 and PP post-tax phases. Dual use of FM and RYO cigarettes was slightly higher in PP year 1, but returned to PP levels during the PP post-tax phase.

Market segments

Table 1 shows the proportion of current cigarette smokers whose current brand was RYO tobacco did not change between the pre-PP and PP year 1 or PP post-tax phases, despite a significantly lower proportion in the transition period. The proportion of current smokers using value FM cigarettes increased significantly between the pre-PP and PP year 1 and PP post-tax periods. Proportions using mainstream and premium brands of FM cigarettes did not change significantly between the pre-PP and later periods.

Use of various types of FM cigarettes

The percentage of FM smokers using menthol cigarettes remained at just under 12% over the course of the study and did not change between the pre-PP and the later three phases (table 1). Overall, 2.1% of FM smokers were currently smoking a king size brand; the proportion did not change over the study period. The percentage of FM cigarette smokers currently smoking a slims brand showed a significant increase PP year 1 compared to pre-PP, however, proportions declined slightly and were not significantly higher during PP post-tax (table 1).

Pack types and sizes of tobacco products purchased

Table 2 shows that the odds of having purchased current packs of FM cigarettes in multipacks significantly increased over the

study period, from 2.9% pre-PP to 4.8% in the transition phase, 6.4% in PP year 1 and 9.4% in the PP post-tax phase (table 2). Odds of having purchased one's current pack as a single pack significantly declined between the pre-PP (84.2%) and the PP year 1 and PP post-tax periods. Carton purchases did not differ between the pre-PP and subsequent phases; 13.1% of packs were purchased this way overall.

Among smokers of FM cigarettes, use of packs containing 20 cigarettes did not change over the course of the study; neither did packs of 30s/35s or 50s (table 2). Use of packs containing between 21 and 23 cigarettes increased from pre-PP to PP year 1, but was not significantly higher in the PP post-tax than pre-PP phase. Packs containing 25 cigarettes significantly declined in popularity from the pre-PP to PP year 1 and PP post-tax periods, while packs of 26 cigarettes significantly increased. Packs containing 40 cigarettes (mostly value brands, but also *Longbeach*, considered a mainstream brand) became more common in the PP post-tax period.

Among current smokers using RYO cigarettes, the proportion using pouches containing 25 g of tobacco increased substantially from pre-PP to the two phases after implementation of PP (table 2). Correspondingly, use of 30 g pouches was significantly lower in the PP post-tax phase compared with pre-PP. Use of larger pouch sizes did not change between periods.

FM brand-variant-pack size combinations

Prior to the introduction of PP, 95% of current FM smokers smoked one of 17 brands, 83 brand-variant combinations and 150 brand-variant-pack-size combinations (results not depicted in tables). During PP year 1, while the number of brands and brand-variants stayed constant, brand-variant-pack-size combinations had increased to 165. The reported number of brand-variant-pack size combinations increased only slightly from pre-PP to PP year 1 for premium brands (33–35 (a 6%

Table 3 Mean real per stick price (\$March 2014) of current FM and RYO cigarettes by phase: means and results of linear regression models

Sample	Time period	Differences between PP phases—unadjusted models			Differences between PP phases—adjusted models		
		Mean cigarette price in cents (SE)	B-weight	95% CI	Mean cigarette price in cents (SE)	B-weight	95% CI
All RYO cigarettes (per 0.8 g) (n=1517)	Pre-PP	57.2 (0.32)	Ref		57.2 (0.32)	Ref	
	Transition	56.6 (0.58)	-0.61	-1.91 to 0.70	56.7 (0.57)	-0.50	-1.78 to 0.78
	PP year 1	59.1 (0.27)	1.82***	0.99 to 2.64	59.1 (0.27)	1.91***	1.09 to 2.74
	PP post-tax	65.2 (0.59)	7.99***	6.67 to 9.31	65.1 (0.58)	7.92***	6.62 to 9.23
All FM cigarettes (n=5559)	Pre-PP	65.2 (0.27)	Ref		65.1 (0.25)	Ref	
	Transition	65.9 (0.45)	0.70	-0.32 to 1.72	65.9 (0.44)	0.82	-0.16 to 1.80
	PP year 1	66.8 (0.21)	1.59***	0.92 to 2.25	66.9 (0.21)	1.80***	1.18 to 2.42
	PP post-tax	72.6 (0.47)	7.41***	6.34 to 8.47	72.6 (0.45)	7.46***	6.46 to 8.45
By FM market segment							
Value FM cigarettes (n=1731)	Pre-PP	55.9 (0.30)	Ref		56.0 (0.30)	Ref	
	Transition	56.6 (0.55)	0.66	-0.56 to 1.89	56.5 (0.55)	0.59	-0.63 to 1.82
	PP year 1	57.3 (0.22)	1.43***	0.69 to 2.17	57.3 (0.22)	1.38***	0.65 to 2.11
	PP post-tax	62.2 (0.45)	6.32***	5.27 to 7.38	62.2 (0.45)	6.23***	5.17 to 7.29
Mainstream FM cigarettes (n=2700)	Pre-PP	66.9 (0.31)	Ref		66.9 (0.30)	Ref	
	Transition	67.5 (0.47)	0.60	-0.50 to 1.70	67.4 (0.47)	0.50	-0.58 to 1.58
	PP year 1	69.4 (0.23)	2.52***	1.77 to 3.28	69.4 (0.23)	2.58***	1.85 to 3.30
	PP post-tax	75.7 (0.59)	8.79***	7.48 to 10.10	75.7 (0.57)	8.87***	7.63 to 10.11
Premium FM cigarettes (n=1126)	Pre-PP	73.1 (0.40)	Ref		72.9 (0.38)	Ref	
	Transition	74.1 (0.78)	1.07	-0.65 to 2.80	74.2 (0.76)	1.35	-0.31 to 3.02
	PP year 1	76.4 (0.35)	3.37***	2.33 to 4.40	76.5 (0.35)	3.64***	2.62 to 4.67
	PP post-tax	84.3 (0.66)	11.18***	9.67 to 12.69	84.4 (0.62)	11.57***	10.14 to 12.99

Of n=8679 cigarette smokers, we excluded those who: did not provide their current brand name (n=283); currently smoked unbranded tobacco or gave a brand of cigars/cigarillos or e-cigarettes (n=60); did not recall where they purchased their pack or received it as a gift (n=75); did not provide a valid pack size (n=231); did not report a price (n=413); purchased tobacco duty free or overseas (n=70); skipped relevant questions due to back-coding of verbatim responses (n=77); gave responses that were deemed unlikely to be correct (such as a non-existent pack size or unrealistically low or high price) (n=243); or did not have socioeconomic status information (n=151). Analysed n=7076.

***p<0.001.

FM, factory made; PP, plain packaging; RYO, roll-your-own.

increase)) and for mainstream brands (36–38 (6%)), but increased by 17 (19%) for value brands (results not in tables).

Prices paid

The proportion of respondents who reported having tried a different brand because it was cheaper, or who had thought in the past month about money spent on smoking, were examined among 8672 FM and/or RYO cigarette smokers (analysis for trying a different brand excluded n=55 who refused, did not know or responded not applicable and n=197 for whom SES could not be determined; analysed n=8420). Analysis for ‘thought about money spent’ excluded n=88 who refused and n=195 for whom SES could not be determined; analysed n=8388. There was no change in the proportion of cigarette smokers trying a different brand from pre-PP (14.6%) to the transition (14.9%) or PP year 1 phases (14.7%), but significantly more smokers did so during the PP post-tax phase (17.9%) compared to pre-PP (adjusted (Adj)OR=1.29, 95% CI 1.03 to 1.60, p=0.025). Similarly, compared to pre-PP (66.9%) a significantly higher percentage of respondents thought about money spent on smoking several or many times in the previous month during the PP post-tax phase (71.0%) (AdjOR=1.22, 95% CI 1.03 to 1.45, p=0.021) (results not in tables).

Table 3 shows that on average, between the pre-PP and PP year 1 phases, inflation-adjusted price paid increased by 1.9 cents per stick for RYO cigarettes (assuming rolled with 0.8 g of tobacco) and by 1.8 cents per stick for FM cigarettes. The increases in the PP post-tax phase were even greater. After adjusting for inflation, RYO cigarettes cost an average 7.9 cents more per 0.8 g after the tax increase, while FM cigarettes cost 7.5 cents more per stick.

We then tested interactions between phase and market segment. The magnitude of the price increase between pre-PP and PP year 1

differed by market segment (interaction F=4.94, p=0.002), with premium brands of FM cigarettes increasing the most (5.0%), and value brands increasing the least (2.3%) (mainstream FM: 3.8%; RYO: 3.4%). The interaction between market segment and the pre-PP and PP post-tax phases was also significant (F=11.88, p<0.001). Again, prices of premium FM cigarettes increased the most (by 15.7%), while prices of value cigarettes increased the least (by 10.7%) (mainstream FM: 13.2%; all RYO: 13.8%) so that the differential between the average stick price of premium compared to value brands widened considerably over the course of the study, from 30.2% pre-PP to 31.3% during transition, 33.5% in PP year 1 and 35.7% PP post-tax (see figure 1).

The magnitude of price increases between the pre-PP and PP year 1 phases also differed by pack size among FM cigarettes (interaction F=3.20, p=0.004; data not shown in tables), with inflation-adjusted prices increasing the most among packs containing 21, 22 or 23 cigarettes (9.9%) or 26 cigarettes (7.8%). Inflation-adjusted prices increased the least among packs of 40 cigarettes (by 0.7%) (20s: 4.0%; 25s: 3.9%; 30s and 35s: 4.2%; 50s: 5.1%). The interaction between pre-PP and the PP post-tax period was also significant (F=6.48, p<0.001): packs of 21–23 cigarettes increased by 22.7%, while packs of 40s increased by only 6.9% (20s: 14.9%; 25s: 14.4%; 26s: 12.7%; 30s and 35s: 12.7%; 50s: 13.2%).

Among current RYO smokers, the interaction between pouch size and pre-PP and PP year 1 was not significant (F=2.27, p=0.079); however, the interaction from pre-PP to PP post-tax was (F=4.39, p=0.004). Pouches containing 25 g of tobacco increased in price by 7.8%, while those containing 30 g increased by 11.7% and those with 50 or 55 g increased by 16.5%. Inflation-adjusted prices paid for pouches containing 35 and 40 g appeared to increase by a smaller amount (3.7%), but the sample size was very small (n=14).

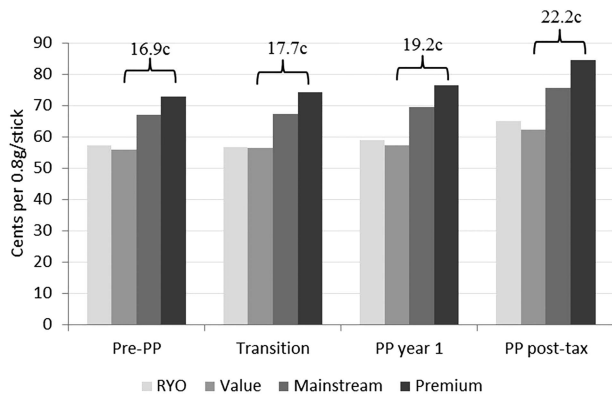


Figure 1 Average reported price paid per single cigarette stick or 0.8 g of roll-your-own tobacco (\$March 2014)—pre-PP, transition, PP year 1 and PP post tax, by market segment and gap between value and premium brands, (cents per stick). Average using adjusted models. PP, plain packaging.

Reported cigarette consumption

Of the 8408 daily, weekly and monthly cigarette smokers in the total sample, we excluded seven respondents who smoked unbranded cigarettes only (ie, they did not smoke any commercial cigarettes), 52 who did not know or refused to give their level of consumption, and 185 for whom SES could not be determined. In total, we analysed consumption among 7218 daily and 946 weekly or monthly smokers.

Changes in consumption following the introduction of PP

We first examined daily cigarette consumption within the first three phases of PP only. Among daily cigarette smokers, there was no change in consumption between pre-PP and the transition phase or PP year 1 period, with an average daily consumption over the first three phases of 15.7 (SE=0.13) cigarettes per day. Nor was any change detected when mean daily consumption was analysed among regular smokers (all those who smoked at least once per week) (mean=14.6, SE=0.13). Mean daily consumption also did not change from the pre-PP to subsequent two phases among current smokers—those who smoked at least monthly, including daily and weekly smokers (mean=14.1, SE=0.13). Furthermore, consumption did not change from pre-PP to the subsequent two phases among current smokers of brands of any market segment (averages over the first three phases—RYO: mean=14.7, SE=0.28; value: mean=16.8, SE=0.27; mainstream: mean=14.1, SE=0.20; premium: mean=10.6, SE=0.29).

Changes in consumption following the 1 December 2013 increase in excise/customs duty

Daily cigarette consumption was then examined using within the PP year 1 and PP post-tax phases only. Mean reported daily consumption among daily smokers was significantly lower PP post-tax (mean=15.1, SE=0.34; Adj B-weight=-0.80, 95% CI -1.56 to -0.05, $p=0.037$) compared to PP year 1 (mean=15.9, SE=0.17). Similarly, there was a significant decline in mean cigarette consumption from PP year 1 (mean=14.8, SE=0.17) to PP post-tax (mean=14.0, SE=0.33) among regular smokers (Adj B-weight=-0.79, 95% CI -0.53 to -0.05, $p=0.037$).

DISCUSSION

This study found clear evidence of an increase in the proportion of current smokers using value brands following the

introduction of PP. Contrary to predictions by the tobacco industry, however, prices paid for cigarettes were higher in all segments of the market, with larger increases rather than the industry-predicted falls in prices among premium brands. Reported consumption did not change following implementation despite the increased availability and use of value brands.

The shift to value brands in 2013 appears to have been driven largely by the increased availability and favourable introductory pricing of value brands in smaller pack sizes. Traditionally value smokers in Australia favoured brands such as *Brandon* and *Stradbroke* (introduced in the early-1990s in packs of 40) and *Holiday* and *Horizon* (introduced in the mid-1990s in packs of 50), however, in more recent times value brands such as *Choice*, *Pall Mall* and *JPS* have been promoted in packs of 20 and 25 as well as the more traditional 40s value format.¹⁰ In the lead-up to PP, two new value brands in small pack sizes were introduced onto the market in Australia—Philip Morris' *Bond Street* 20s and 26s and British American Tobacco's *Just Smokes* 25s. Imperial Tobacco also introduced several new extensions to its *JPS* range such as *JPS Nano* 23s, *JPS 26s*, *JPS Ice* 20s (menthol) and *JPS Duo* 20s (menthol hybrid). All of these packs featured striking pack design (such as grip patterns similar to that on some mobile phones on the *Nano* and fluorescent blue on the *JPS Ice* menthols), and substantially lower up-front purchase prices.³⁵ *JPS* 40s was also added to the range for smokers who still preferred large pack sizes. Products such as these might be thought to constitute a fourth new price segment in Australia, being termed in the UK and New Zealand as 'ultra-value'⁵² or 'budget'.⁵³ 'Supervalue' products have directly competed not just with value packs of 40s and 50s with much higher upfront purchase costs, but also with mainstream brands such as *Winfield* 25s and *Peter Jackson* 30s which cost considerably more per stick and per pack. Similar to industry reports to shareholders,^{40 41} data from this tracking survey suggests that *JPS* has been particularly successful in attracting market share for Imperial Tobacco.⁵⁴

Our study has several limitations. Although the sample size was large, it was difficult to detect small changes in use of low-frequency products such as slims and unusual new pack sizes such as 22s. Since this is a cross-sectional study we were unable to ascertain what component of the higher proportion of smokers smoking value brands in later phases compared to the pre-PP period were new smokers entering the market or existing smokers who had shifted from premium to value brands, or whether there may have been differentially more quitting among premium compared to value brand smokers. Longitudinal studies will be required to establish the extent of shifts in brands and brand styles among existing smokers.

Several pieces of evidence suggest that the shift to value brands observed in this study and reported in industry shareholder communications^{12 55} were predominantly due to the tax increases and pricing strategy purposefully adopted by tobacco companies rather than to a reduced commitment to and valuing of established brands by consumers resulting from PP. First, sales of super-value brands have been increasing exponentially in Australia since the major increase in excise/customs duty in Australia in April 2010, well before the introduction of PP.^{9 56–60} Second, the increase in the number of brand-variant-pack size combinations available in the value segment predated the introduction of PP and indeed appeared to rely on packaging to emphasise product characteristics.³⁵ Third, although excise/customs duty in Australia applies equally to every cigarette regardless of price segment, average recommended retail prices increased more for premium than for value brands after the August 2012 and February and August 2013 indexations of duty

were accommodated.³⁶ Fourth, the percentages of smokers who reported that they had tried a different brand because it was cheaper or thought about how much they were spending on cigarettes in the PP year 1 phase were no higher than in the pre-PP phase but were significantly higher after the December 2013 tax increase a year after introduction of PP. Finally and most importantly it should be noted that similar shifts, particularly by low-SES smokers, from premium to discount brands have been observed in many other countries following large tax increases.^{53 61–63} A particularly marked increase in brand switching from premium to discount cigarettes was observed after 2009 corresponding to the \$0.61 increase in the federal excise tax on cigarettes in the USA.^{61 62} Notable shifts to use of ultra-value brands have also recently been documented after increases in taxes on tobacco in the UK⁵² and New Zealand⁵³ which were comparable in magnitude to recent increases in taxes on tobacco products in Australia.^{43 44}

Variation in pack size remains a powerful form of promotion in Australia that reduces the effectiveness of tax policy in discouraging consumption of tobacco products. The strategy of providing extra cigarettes per pack was used to full effect by tobacco companies in the lead up to introduction of PP. Governments contemplating PP legislation elsewhere would be well advised to include provision in such legislation to standardise the number of cigarettes per pack.

The decline in reported consumption by (remaining) regular smokers following the 12.5% increase in excise/customs duty in December 2013 was as expected based on internationally accepted estimates of price elasticity of about -0.4% .^{45 64} This is despite December 1 perhaps not being optimal timing for a duty increase with end-of-year festivities and summer holidays posing many risks of relapse for smokers who may have quit. Changes in consumption following increases in 2014, 2015 and 2016^{43 44} should be monitored to ascertain whether at the more conducive timing of September 1, price elasticity of demand in the PP environment might be even greater than previously observed.

Use of king-sized cigarettes remained low and there was no increase in the use of menthol cigarettes. It is possible that PP legislation has prevented the development of a market for such products in Australia, however, the small but significant increase in use of slims following the introduction of PP suggests that use of such novel cigarettes should continue to be monitored particularly among young people. Other countries

contemplating tobacco PP legislation should specifically prohibit slim cigarettes as the Australian example demonstrates that mandated increases in packaging dimensions is not a sufficient means of outlawing these products.³⁵

Industry claims that PP would lead to a collapse in prices and increased consumption of tobacco products have not been borne out. Scheduled large increases in excise/customs duty,^{43 44} are likely to further reduce consumption but will no doubt also further accelerate the shift to value brands in Australia. The findings of this study suggest regulation of price-based promotion such as multibuy and novel pack sizes as a new frontier in tobacco control to be tackled by governments in Australia.

Contributors MS and MW designed this study. MZ cleaned data files, undertook analysis and reported results. KC undertook additional analysis and MB provided additional advice on analysis. MS drafted the manuscript with contributions from all authors. All authors approved the final manuscript.

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Competing interests The authors wish to advise that MS was a technical writer for and MW a member of the Tobacco Working Group of the Australian National Preventive Health Task Force and MW was a member of the Expert Advisory Committee on Plain Packaging that advised the Australian Department of Health on research pertaining to the plain packaging legislation. MW holds competitive grant funding from the Australian National Health and Medical Research Council and MW holds competitive grant funding from the US National Institutes of Health, Australian National Preventive Health Agency and BUPA Health Foundation.

Ethics approval The survey was approved by the Cancer Council Victoria Human Ethics Committee (HREC 0018).

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What this paper adds

What is already known on this topic

- ▶ The tobacco industry vigorously opposed the introduction of plain packaging in Australia and warned of many unintended consequences, in particular a shift to use of low-cost cigarettes and a consequent increase in tobacco consumption.

What this paper adds

- ▶ Use of value brands did increase following the introduction of plain packaging (PP), however, this appears to have been driven by the introduction of smaller pack sizes in value brands in the months leading up to the introduction of PP, combined with larger increases in prices of premium brands relative to value brands.
- ▶ Among smokers, reported number of cigarettes smoked did not change after PP introduction, but did reduce among regular smokers post a 12.5% tax increase.

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