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RESEARCH ARTICLE

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The impact of new health warnings on standardized packaging on warning salience and effectiveness, and longer-term response to warnings on standardized packs: a longitudinal online survey in the United Kingdom

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ABSTRACT

Background: Evaluative research suggests that implementing standardized cigarette packaging with new larger pictorial health warnings is associated with increased warning salience and effectiveness. However, in countries with standardized packaging, little is known about how smokers respond to novel on-pack warnings. There is also limited research exploring longer-term response to warnings on standardized packs.

Methods: The Adult Tobacco Policy Survey is a four-wave longitudinal online survey following a cohort of smokers aged 16 and older in the United Kingdom. Wave 1 was conducted pre-standardized packaging (2016) and waves 2–4 post-standardized packaging (2017, 2019 and 2022 respectively). A new set of warnings was introduced on standardized packs between waves 3 and 4. We explored the impact of these new warnings and longer-term response to warnings on standardized packs.

Results: There were no statistically significant differences on any warning measure between waves 3 and 4. However, noticing warnings on packs, reading or looking closely at them, thinking about them, thinking about the risks, most avoidant behaviors (covering warnings, putting the pack away, using a cigarette case/alternative container), and forgoing cigarettes, were significantly higher at Wave 4 than at Wave 1.

Conclusions: The findings suggest that in markets with standardized packaging, changing the warnings, while using similar messaging and retaining the same warning size and layout, may help reduce wearout but may be insufficient to significantly increase how noticeable and effective they are. The findings provide support for the long-term benefits of simultaneously introducing standardized packaging with new, larger warnings.

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Tobacco; policy; survey; longitudinal

Introduction

More than 20 countries or territories have fully implemented standardized (or plain) packaging (Canadian Cancer Society 2024). While the rationale for standardized packaging and products covered may differ across countries to have implemented this policy (Moodie et al. 2022), it is generally intended to discourage tobacco use by reducing the appeal of tobacco products, reducing the ability of the packaging to mislead consumers about associated harms, and increasing warning salience and effectiveness (Moodie et al. 2019).

Evaluative research with adult smokers exploring the impact of standardized packaging on warning salience and effectiveness suggests this objective has been met in some countries but not others. For instance, continuous cross-sectional surveys in Australia found that following the introduction of standardized packaging warnings on packs were more salient, with participants more likely to worry about the warnings, avoid them, and think about or be motivated to quit because of them (Dunlop et al. 2014; Wakefield et al. 2015). Longitudinal surveys with adult smokers found, post-standardized packaging, an increase in warning salience in Australia (Yong et al. 2016) and the UK (Aleyan et al. 2020; Moodie et al. 2023) and an increase in reporting that warnings made them consider quitting in Singapore

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(Ng et al. 2024). However, longitudinal surveys in Canada (Gravely et al. 2023) and Norway (Moodie et al. 2021) did not find any change in warning salience or effectiveness post-standardized packaging.

That Australia, Singapore and the UK simultaneously introduced standardized packaging and novel larger pictorial warnings, while Canada and Norway introduced standardized packaging while retaining the warnings that had been on packs for several years, may help to explain these findings given that warnings tend to lose their impact over time (Li et al. 2015; White V et al. 2015; Woelbert and d'Hombres 2019). What has not been explored, to the best of our knowledge, is the impact, if any, that refreshing warnings on standardized packs has on salience and effectiveness. There is also a paucity of research exploring the longer-term response of adult smokers to large pictorial warnings on standardized packaging.

In the UK, standardized packaging for cigarettes (factory-made and hand-rolled) was introduced at the same time as novel pictorial warnings which cover 65% of the main display areas. Prior to this, fully-branded packs included a text warning covering 43% of the pack front and a pictorial warning covering 53% of the pack reverse (UK Government 2016). A new set of pictorial warnings on standardized packs was phased-in from January 2021, as part of the Tobacco Products and Nicotine Inhaling Products Regulations (UK Government 2019). Figure 1 shows examples of warnings on packs pre-standardized packaging, post-standardized packaging, and post-Tobacco Products and Nicotine Inhaling Products Regulations. Supplementary Table 1 shows the warning messages before and after the Tobacco Products and Nicotine Inhaling Products Regulations.

Research is needed to understand the impact, if any, that including new warnings on standardized packs has on warning salience and effectiveness, and also to explore the long-term impact of standardized packaging on warning salience and effectiveness (Edwards et al. 2023).

Methods

Design and sample

The 'Adult Tobacco Policy Survey' (ATPS) is a longitudinal online survey in the UK following a cohort of smokers. To be eligible for inclusion at baseline, participants had to be 16 or over and report smoking cigarettes (factory-made and/or hand-rolled) in the last three months. The sample was recruited at Wave (W)

Figure 1. Examples of warnings on cigarette packs at Wave 1 (top row), Wave 2 (second row), Wave 3 (third row) and Wave 4 (bottom row).

1 from the non-probability online adult panel of market research company YouGov. Randomly selected panel members whose profiling data suggested they were smokers received an e-mail invite to participate and a survey link if they chose to do so.

Recruitment for W1, before standardized packaging was introduced (April–May 2016), was by quota sampling for age, gender, government office region, and tobacco consumption to represent the national profile of smokers aged 16 and over in the UK, based on the Opinions and Lifestyle Survey and Integrated Household Survey (Moodie et al. 2019). Cigarette smokers recruited at W1 were followed up at three subsequent waves. All were eligible for inclusion at each subsequent wave, even if they missed a wave and irrespective of whether they continued to smoke or not. W2 was conducted 4–6 months post-standardized packaging (September–November 2017), W3 was conducted 24–26 months post-standardized packaging (May–July 2019), and W4 was conducted 69–71 months post-standardized packaging and 21–23 months after the new warnings were required on packs (October–November 2022). Participants received a small incentive, in the form of points which could be exchanged for shopping vouchers, at each wave.

At W1 there were 6233 cigarette smokers (6026 [96.7%] at least monthly smokers and 207 [3.3%] less than monthly smokers). Of those recruited at W1, 4293 participated at W2 (3557 [82.9%] at least monthly cigarette smokers, 607 [14.1%] ex-cigarette smokers, 36 [0.8%] non-cigarette smokers, 79 [1.8%] cigarette smokers that had not smoked in the past month, 14 [0.3%] missing data), 3175 at W3 (2345 [73.9%] at least monthly cigarette smokers, 700 [22.0%] ex-cigarette smokers, 44 [1.4%] non-cigarette smokers, 73 [2.3%] cigarette smokers that had not smoked in the past month, 13 [0.4%] missing data), and 3047 at W4 (1885 [61.8%] at least monthly cigarette smokers, 1043 [34.2%] ex-cigarette smokers, 45 [1.5%] non-cigarette smokers, 59 [1.9%] cigarette smokers that had not smoked in the past month, 15 [0.5%] missing data).

Average age at the most recent wave (W4) was 53.9 years (SD 13.8), with 90.7% white British, and most of the sample from England (83.6%). The profile of the monthly smokers included in the primary analysis at each wave can be seen in Table 1. The study received ethical approval from the University of Stirling, with the first two waves approved by the Faculty of Health Sciences and Sport Ethics Committee, and the last two waves by the General University Ethical Panel (GUEP 8359).

Measures

Demographics and smoking status

Information was captured on age, sex, ethnicity, household income, highest level of education, employment status, work type, and social grade. Social grade was determined by occupation of the main income earner within the household using the National Readership Survey, a classification system in the UK with grades A, B and C1 signifying middle and upper class groups and C2, D and E working class groups (National Readership Survey undated). Participants who indicated that they smoked daily, weekly, or within the last month were considered current cigarette smokers.

Warning salience

Participants who smoked cigarettes were asked how often, if at all, they noticed the warnings on packs in the last 30 days and how often, if at all, they read or looked closely at them in the last 30 days; all warning measures have been used within the International Tobacco Control (ITC) project, a large on-going cohort study examining tobacco and nicotine use across multiple countries (Borland et al. 2009; Yong et al. 2016; Trofor et al. 2019). Response options were 'never', 'rarely', 'sometimes', 'often', 'very often' or 'don't know'. This was recoded to 'often' or 'very often' versus other responses with 'don't know' coded as missing.

Cognitive response to warnings

Participants who smoked cigarettes were asked how often, if at all, they thought about what the warnings on packs were telling them in the last 30 days and to what extent, if at all, the warnings on packs made them think about the health risks of smoking. The response options for thinking about the health risks of smoking were 'not at all', 'a little', 'somewhat', 'a lot' or 'don't know'. Responses were recoded to 'a lot' versus other responses, with 'don't know' coded as missing.

Avoidant and cessation-related behaviors

Participants who smoked cigarettes were asked to what extent, if at all, the warnings on packs made them more likely to quit smoking, how often, if at all, the warnings stopped them from having a cigarette when they were about to smoke in the last 30 days,

Table 1. Characteristics of current (at least monthly) smokers by survey wave.

		Wave			
		1 % (*n*)	2 % (*n*)	3 % (*n*)	4 % (*n*)
Sex	Male	46.6% (2808)	46.8% (1663)	48.1% (1128)	47.1% (888)
	Female	53.4% (3218)	53.3% (1894)	51.9% (1217)	52.9% (997)
Age group	16–24	9.6% (578)	5.1% (183)	4.1% (97)	2.8% (53)
	25–39	28.6% (1721)	24.0% (855)	23.5% (551)	23.5% (443)
	40–55	33.5% (2017)	36.9% (1314)	37.2% (873)	39.9% (752)
	56+	28.4% (1710)	33.9% (1205)	35.1% (824)	33.8% (637)
Ethnic group	White British	88.6% (5340)	90.1% (3204)	90.2% (2115)	90.5% (1706)
	White other	5.5% (332)	4.6% (162)	4.2% (99)	3.7% (69)
	Other	4.9% (295)	4.4% (157)	4.4% (103)	5.0% (94)
	Prefer not to say	1.0% (59)	1.0% (34)	1.2% (28)	0.9% (16)
Highest level of education	High school or less	33.3% (2008)	35.6% (1265)	36.4% (853)	38.7% (730)
	Technical, trade school, A levels, or community college	25.4% (1530)	23.0% (817)	22.1% (519)	21.6% (407)
	Don't know or prefer not to say	3.1% (189)	3.2% (112)	2.9% (68)	2.9% (55)
Gross household income	Under £30,000	46.1% (2778)	46.1% (1638)	44.1% (1035)	43,1% (813)
	£30,000–£44,999	20.7% (1249)	20.3% (722)	21.3% (499)	20.3% (382)
	£45,000 and over	15.2% (916)	15.0% (534)	16.3% (383)	17.7% (333)
	Don't know or prefer not to answer	18.0% (1083)	18.6% (663)	18.3% (428)	18.9% (357)
Employment status	Employed	59.9% (3608)	59.7% (2123)	59.0% (1384)	56.2% (1060)
	Full time student	5.3% (321)	2.4% (85)	1.1% (26)	0.3% (6)
	Retired	15.9% (959)	20.1% (716)	22.7% (532)	27.8% (524)
	Unemployed	5.3% (317)	4.0% (143)	4.1% (96)	3.3% (62)
	Not working/other	13.6% (821)	13.8% (490)	13.1% (307)	12.4% (233)
Work type	Other or have never worked	13.1% (792)	13.8% (490)	11.2% (262)	12.4% (233)
	Above skilled manual	65.4% (3941)	64.9% (2307)	67.4% (1581)	65.7% (1239)
	Manual	21.5% (1293)	21.4% (760)	21.4% (502)	21.9% (413)
NRS[a] Social grade	ABC1[b]	56.9% (3427)	55.8% (1984)	55.8% (1309)	53.4% (1006)
	C2DE[b]	40.3% (2426)	41.5% (1476)	42.9 (1007)	41.4% (781)
	Refused or unknown	2.9% (173)	2.7% (97)	1.2% (29)	5.2% (98)
Smoking frequency	Non-daily	25.8% (1557)	20.8% (741)	18.8% (440)	17.4% (327)
	Daily	74.2% (4469)	79.2% (2816)	81.2% (1905)	82.7% (1558)
Total		100.0% (6026)	100.0% (3557)	100.0% (2345)	100.0% (1885)

[a]National Readership Survey. [b]ABC1 includes professional, managerial, supervisory, clerical and administrative occupations. C2DE includes skilled, semi-skilled and unskilled manual occupations and the unemployed.

and whether they did any of the following to avoid looking at the warnings on packs in the last 30 days: avoided buying packets with particular warnings on them; covered the warnings to avoid looking at them; put the pack away to avoid looking at the warning; used a cigarette case or some other pack to avoid looking at the warnings. Response options for the avoidance questions were 'yes', 'no' or 'don't know', with 'don't know' coded as missing.

Analysis

Descriptive statistics for the cognitive response to warnings at each survey wave are presented as percentage and number of monthly smokers at that wave responding 'often' or 'very often'. Analysis of change in frequency of responses between survey waves was conducted with generalized estimating equations (GEE), which account for the non-independence of repeated observations on individuals. The working correlation structure was exchangeable. All analyses were adjusted for sex, age at baseline, education, gross household income, and cigarettes per day at baseline. Only past-month cigarette smokers at each wave were included in the analyses of change over time; we focused on past-month smokers given the timeframe of most warning measures was last 30 days. Additional sensitivity analyses were conducted that restricted the included sample firstly, to those who were daily smokers and then to at least monthly smokers who had taken part in all four waves of the survey. Results are presented as the adjusted odds ratio and its 95% confidence interval. All analyses were conducted in Stata version 17.

Results

Response frequencies for each warning variable at each wave are shown in Table 2. While proportions for several variables were slightly higher in W4 versus W3, no statistically significant differences for any outcomes were found. However, when examining W4 versus W1 salience, reporting noticing warnings often or very often was significantly higher at W4 than W1

Table 2. Current smokers' responses to questions on warnings by survey wave.

	Wave			
	1 % (*n*)	2 % (*n*)	3 % (*n*)	4 % (*n*)
Notice warnings (often/very often)	24.9% (1485)	40.7% (1434)	31.7% (732)	34.7% (646)
Read warnings (often/very often)	8.5% (504)	16.5% (585)	12.6% (292)	13.0% (243)
Think about warnings (often/very often)	8.8% (525)	14.8% (520)	12.4% (287)	11.8% (220)
Think about risks of smoking (a lot)	6.2% (371)	8.8% (308)	7.3% (168)	7.1% (132)
Avoided warnings	2.3% (137)	3.4% (119)	2.7% (62)	2.8% (51)
Covered warnings	8.9% (530)	16.5% (580)	12.0% (277)	13.2% (245)
Put pack away to avoid warnings	10.2% (608)	19.3% (676)	14.7% (338)	15.2% (281)
Used case to cover warnings	4.4% (260)	12.2% (428)	9.7% (223)	9.7% (181)
Forgone a cigarette due to warnings	9.3% (551)	11.7% (407)	10.9% (250)	11.3% (207)
More likely to quit due to warnings (a lot)	2.2% (128)	3.4% (117)	2.6% (59)	2.6% (47)

(Odds Ratio (OR) = 1.68, Confidence Interval (CI) 1.53, 1.85), as was reading warnings often or very often (OR = 1.78, CI 1.54, 2.05). For cognitive warning response, thinking about warnings often or very often was significantly higher at W4 than W1 (OR = 1.49, CI 1.29, 1.73), as was thinking about health risks often or very often (OR = 1.25, CI 1.05, 1.50). For avoidant and cessation-related behaviors, covering warnings (OR = 1.66, CI 1.44, 1.91), putting pack away because of the warnings (OR = 1.79, CI 1.57, 2.04), using a case (OR = 2.21, CI 1.84, 2.65), and forgoing cigarettes due to warnings (OR = 1.35, CI 1.18, 1.54) were significantly higher at W4 than W1. The results of sensitivity analyses are shown in Supplementary Tables 2 and 3. The pattern of results is the same if excluding participants that did not complete all four survey waves, or if only including daily (rather than monthly) smokers; the only difference for daily smokers was that they were significantly more likely to report that that they were a lot more likely to quit due to warnings at W4 than W1 (OR = 1.45, CI 1.01, 2.08) (Supplementary Table 2) (Table 3).

Discussion

We found no significant differences on any warning item at W4 compared to W3. This suggests that refreshing warning images and introducing some new messages on standardized packs while maintaining the same format (layout and size) is not sufficient to increase warning salience and effectiveness. However, that there were no significant declines on any warning measure between Waves 3 and 4 may also suggest that the new warnings helped reduce wear-out.

Comparing warning responses over time, all measures at W4 were significantly higher than at W1, aside from avoiding buying packs with particular warnings and whether the warnings made them think a lot about quitting, although the odds ratios for these items were in a similar direction. A sensitivity analysis including only daily smokers, those likely to have the highest exposure to warnings, showed that they were significantly more likely to think a lot about quitting due to the warnings at W4. These findings suggest that standardized packaging with large pictorial warnings on the main display areas is associated with greater warning salience and effectiveness than fully-branded packaging with text warnings on the pack front and smaller pictorial warnings on the pack reverse, and that this persisted for over five years.

There was no significant change on any warning measure between Waves 3 and 4. This is in contrast to the significant decline on all ten warning measures between Waves 2 and 3 (Moodie et al. 2021). The lack of any further decline in warning responses between Waves 3 and 4 may point to a reduction in wear-out, which occurs for all warnings (Argo and Main 2004; Hammond 2011) and appears to occur for tobacco products irrespective of pictorial health warning format (Pang et al. 2021), and therefore provides some support for the new set of warnings. Whether the similarity of warnings between Waves 3 and 4, where the warning format (size and layout) was unchanged and several messages were identical (Smoking clogs arteries, Smoking damages your teeth and gums) or similar (e.g. Smoking causes mouth and throat cancer vs Smoking causes throat cancer), prevented an increase in warning salience and effectiveness at Wave 4 is not clear. What is likely is that any reduction in wear-out will have been temporary as the current set of 13 warnings in the UK are non-rotating and research consistently shows that smokers become desensitized over time (Li et al. 2015; Woelbert and d'Hombres 2019).

An option to help increase consumer attention to novel on-pack warnings, or indeed other legally required pack changes, would be to accompany their roll-out with public education efforts. Research in Australia (Brennan et al. 2011; Nagelhout et al. 2015)

Table 3. Comparison of responses in Wave 4 to those in Wave 3 and Wave 1 by GEE.

	Wave 4 v Wave 3 aOR (95% CI)	Wave 4 v Wave 1 aOR (95% CI)
Notice warnings (often/very often)	1.11 (1.00, 1.24)	**1.68 (1.53, 1.85)**
Read warnings (often/very often)	1.02 (0.88, 1.19)	**1.78 (1.54, 2.05)**
Think about warnings (often/very often)	0.93 (0.80, 1.09)	**1.49 (1.29, 1.73)**
Think about risks of smoking (a lot)	0.96 (0.79, 1.17)	**1.25 (1.05, 1.50)**
Avoided warnings	0.86 (0.61, 1.21)	1.17 (0.82, 1.65)
Covered warnings	1.05 (0.90, 1.23)	**1.66 (1.44, 1.91)**
Put pack away to avoid warnings	1.03 (0.90, 1.18)	**1.79 (1.57, 2.04)**
Used case to cover warnings	0.98 (0.82, 1.16)	**2.21 (1.84, 2.65)**
Forgone a cigarette due to warnings	1.02 (0.88, 1.18)	**1.35 (1.18, 1.54)**
More likely to quit due to warnings (a lot)	0.97 (0.71, 1.34)	1.31 (0.98, 1.75)

aOR (95% CI) adjusted for age, education, smoking frequency at baseline, income. $n = 6047$, obs = 13,657 **$p < 0.05$ in bold**.

and Bangladesh (Turk et al. 2018) has found support for the use of mass-media educational campaigns accompanying the introduction of new pictorial warnings. Such campaigns can help increase attention toward warnings and knowledge of harms, and are associated with increased quit intentions or attempts (Brennan et al. 2011; Nagelhout et al. 2015; Turk et al. 2018).

While the ATPS is the only UK-wide longitudinal survey aimed at assessing the response of smokers and ex-smokers to standardized packaging, this study had several limitations. The non-probability sampling design and overrepresentation of participants from higher social grades (ABC1), means that the findings may not be generalizable to the wider population of smokers. Our quota sampling at W1 did not include ethnicity, with our sample under-representing non-White individuals, which may have affected the findings. Attrition was evident across waves, which may have affected the findings. Although online panel surveys are widely used by researchers and policymakers, panel sampling may be susceptible to economic self-selection, which can bias the socioeconomic composition of a sample and indirectly affect non-demographic variables (Lehdonvirta et al. 2021). The findings are also reliant on self-report, which may not reflect actual behaviors or lead to behavior change, and may be affected by socially-desirable responses.

In conclusion, the findings suggest that standardized packs with pictorial warnings remain more salient and effective over time than fully-branded packaging with weaker (smaller, text/pictorial) warnings. Refreshing warnings on cigarette packaging without increasing warning size or layout, and while retaining similar messaging for multiple warnings, may help to slow warning wear-out but appears insufficient to significantly increase warning salience and effectiveness.

Disclosure statement

The views expressed are those of the authors and not necessarily those of the NHS, the National Institute for Health Research, the Department of Health and Social Care or its arm's length bodies, and other Government Departments.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, CM, upon reasonable request.

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