Association between tobacco plain packaging and Quitline calls: a population-based, interrupted time-series analysis

Abstract

Objectives: To investigate whether the introduction of tobacco plain packaging in Australia from 1 October 2012 was associated with a change in the number of calls to the smoking cessation helpline, Quitline, and to compare this with the impact of the introduction of graphic health warnings from 1 March 2006.

Design and setting: Whole-of-population interrupted time-series analysis in New South Wales and the Australian Capital Territory between 1 March 2005 and October 2006 for the comparator, graphic health warnings, and October 2011 and April 2013 for the intervention of interest, tobacco plain packaging.

Main outcome measure: Weekly number of calls to the Quitline, after adjusting for seasonal trends, anti-tobacco advertising, cigarette costliness and the number of smokers in the community.

Results: There was a 78% increase in the number of calls to the Quitline associated with the introduction of plain packaging (baseline, 363/week; peak, 651/week [95% CI, 523–780/week; P < 0.001]). This peak occurred 4 weeks after the initial appearance of plain packaging and has been prolonged. The 2006 introduction of graphic health warnings had the same relative increase in calls (84%; baseline, 910/week; peak, 1673/week [95% CI, 1383–1963/week; P < 0.001]) but the impact of plain packaging has continued for longer.

Conclusions: There has been a sustained increase in calls to the Quitline after the introduction of tobacco plain packaging. This increase is not attributable to anti–tobacco advertising activity, cigarette price increases nor other identifiable causes. This is an important incremental step in comprehensive tobacco control.

Methods

We used an interrupted time-series analysis to investigate trends in the weekly volume of calls from New South Wales and the Australian Capital Territory to the Quitline.

As plain packs were phased in from 1 October 2012, we considered this date the start of the intervention. Similarly, 1 March 2006 was the date of the introduction of graphic health warnings on cigarette packaging. We looked at Quitline call numbers before and after these dates for the two interventions. Call data from 1 April 2004 to 28 February 2006 were provided by Macquarie Telecom (Sydney, Australia) and from 1 March 2006 to 31 March 2013 by the Telstra Analyst (Telstra, Melbourne, Australia).

This study did not require institutional ethics approval as it did not involve data about individuals. The study received no external funding. Reporting of the study complies with the STROBE (STrengthening the Reporting of Observational studies in Epidemiology) consensus guidelines for reporting observational studies.

Potential confounders

An increase in anti-smoking advertising in mass media such as television is
a potential confounder as it increases the number of calls to the Quitline.\textsuperscript{2,3,6} We ascertained weekly target audience rating points (TARPs) for advertisements broadcast in NSW and the ACT during the periods of interest, using OzTAM (Australian television audience measurements) for adults aged 18 years and older for free-to-air and cable television using established methods (unpublished report prepared by OzTAM for the Cancer Institute NSW). TARPs are a product of the percentage of the target audience exposed to an advertisement (reach) and the average number of times a target audience member would be exposed (frequency), adjusted for the length of the advertisement. For example, 200 TARPs might represent 100% of the target audience receiving the message twice on average over a specified period, or 50% reached four times.

Another potential confounder is cigarette costliness. We followed Wakefield et al\textsuperscript{10} and calculated cigarette costliness as the ratio of the average quarterly recommended retail price for a pack of the two top-selling Australian cigarette brands (obtained from the retail trade magazine \textit{Australian Retail Tobacconist}, volumes 65 to 87) to the average weekly earnings in the same quarter obtained from the Australian Bureau of Statistics.\textsuperscript{11}

Finally, the number of smokers in the community can be a potential confounder. We obtained data on smoking prevalence during the study periods from Health Statistics New South Wales,\textsuperscript{12} and this was applied to quarterly figures for population size from the Australian Bureau of Statistics\textsuperscript{13} to calculate the number of smokers in the community. Data for the first quarter of 2012 were not available, so we used results carried forward from the final quarter of 2011.

### Statistical analyses
As the data for weekly number of calls to the Quitline were autocorrelated (each value was correlated with the previous value) we used autoregressive integrated moving average (ARIMA) analysis in SAS version 9.3 (SAS Institute Inc). ARIMA models enable the investigation of changes over time while accounting for seasonal variation and background trends in such things as the effects of television anti-tobacco advertising, changes in cigarette pricing relative to weekly earnings and number of smokers in the community. In ARIMA modelling, comprising model investigation, estimation and diagnostic checking, we followed the methods of Box et al (Appendix; online at mja.com.au).\textsuperscript{14}

A single model fitted to the entire 7-year period of Quitline call data did not meet technical criteria for model fit. Therefore, separate models that included data for 12 months before and after the introduction of plain packaging and graphic health warnings were fitted to the 7-year data set.
3 Change in numbers of call to Quitline after the introduction of plain packaging and graphic health warnings, adjusted for anti-tobacco advertising, seasonal trend, smoking prevalence and tobacco costliness*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Graphic health warnings</th>
<th>12-week time to peak</th>
<th>Plain packaging</th>
<th>4-week time to peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Peak number of additional calls</td>
<td>762.88 (147.88)</td>
<td>&lt; 0.001</td>
<td>288.18 (65.48)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Weekly decay in number of additional calls</td>
<td>0.60 (0.24)</td>
<td>0.095</td>
<td>0.14 (0.10)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of calls to Quitline attributable to confounders</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target audience rating points (TARPs)</td>
<td>1.47 (0.20)</td>
<td>&lt; 0.001</td>
<td>0.08 (0.11)</td>
<td>0.47</td>
</tr>
<tr>
<td>New Year period</td>
<td>199.38 (169.49)</td>
<td>0.24</td>
<td>12718 (43.74)</td>
<td>0.004</td>
</tr>
<tr>
<td>Smoking prevalence (per 100 000 smokers)</td>
<td>-275.26 (230.15)</td>
<td>0.23</td>
<td>90.54 (595.37)</td>
<td>0.88</td>
</tr>
<tr>
<td>Cigarette costliness (per 1% increase relative to average earnings)</td>
<td>428.98 (54.25)</td>
<td>0.43</td>
<td></td>
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</tr>
</tbody>
</table>

*Full model details can be supplied by the authors on request.

Discussion

We found a significant increase in the number of calls to Quitline coinciding with the introduction of mandatory plain packaging of tobacco after other known confounders had been taken into account. Australia has taken a lead on mandating plain packaging, now supported by evidence of an immediate impact of this legislation. This should encourage other countries that are preparing similar legislation.

We also found that, compared with the introduction of an earlier smoking cessation initiative — graphic health warnings — the effect of plain packaging had a more immediate effect, a slightly smaller peak and a much longer duration of impact.

These changes need to be interpreted in the context of the earlier introduction of graphic health warnings and a raft of other legislated tobacco control policies, and secular trends in smoking rates. It is possible that the magnitude and duration of effect could be different in countries that are implementing aspects of the Framework Convention on Tobacco Control in different ways or different orders. For example, in NSW, the most recently legislated changes include the widespread introduction of smoke-free public spaces from 2007,16,17 and banning the display of tobacco products at the point of sale in 2010.18,19 Furthermore, smoking prevalence has declined markedly from 17.7% of NSW residents reporting daily or occasional smoking in 2006 to 14.7% in 2011.12

A key strength of this study was the ability to account for other known influences on quitting behaviour and use of the Quitline:

- anti-tobacco advertising activity;
- the costliness of tobacco;
- the number of smokers in the community; and
- seasonal peaks that are observed in the New Year period.

Although the volume of calls to the Quitline is an indirect measure of quitting intentions and behaviour, it does provide an objective outcome measure that is not subject to selection or social desirability biases that may occur in community surveys. Quitline data are available almost in real time so that the immediate...
impact of community-wide programs or policies can be evaluated soon after implementation. Interrupted time-series analysis provides one of the most robust methods of evaluating the impact of programs and policies that affect the whole population.\textsuperscript{20} We examined legislation enacted nationally simultaneously, precluding the use of a control group.

A weakness of our study is its inability to differentiate the impact of the increased size of graphic health warnings that happened simultaneously with tobacco plain packaging from the impact of plain packaging itself. Quitline calls are one measure of changes in people’s behaviour in response to legislative change. The rate of calls to Quitline may have been confounded by the Quitline telephone number appearing to be more prominent in the absence of proprietary branding. Also, our study has shown an association but cannot prove causation.

Longer-term investigation of the impact of the legislation should include assessment of more direct measures:

- smoking uptake in non-smokers;
- prevention of relapse among ex-smokers; and
- cessation of smoking among current smokers.

This would include the need to investigate variations in impact on subgroups of the population. A comprehensive evaluation of the policy will require ongoing monitoring to assess factors such as changes in brand recognition, awareness of the health risks of smoking, the social acceptability of smoking as well as smoking prevalence.\textsuperscript{21}

In conclusion, we showed a significant increase in the number of calls to the Quitline that coincided with the introduction of plain packaging nationally in Australia. Future evaluations of other smoking-related outcomes need to include the impact on smoking prevalence.

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