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THE FREEZE ON MASS MEDIA CAMPAIGNS IN ENGLAND: A NATURAL EXPERIMENT OF THE IMPACT OF TOBACCO CONTROL CAMPAIGNS ON QUITTING BEHAVIOUR

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ABSTRACT

Aims

To measure the impact of the suspension of tobacco control mass media campaigns in England in April 2010 on measures of smoking cessation behaviour.

Design

Interrupted time series design using routinely-collected population-level data. Analysis of use of a range of types of smoking cessation support using segmented negative binomial regression.

Setting

England.

Measurements

Use of non-intensive support: Monthly calls to the National Health Service (NHS) quitline (April 2005-September 2011), text requests for quit support packs (December 2007-December 2010), and web hits on the national smoking cessation website (January 2009-March 2011). Use of intensive cessation support: Quarterly data on the number of people setting a quit date and 4-week quitters at the NHS Stop Smoking Services (SSS) (quarter 1 2001-quarter 3 2011).

Findings

During the suspension of tobacco control mass media spending, literature requests fell by 98% (95% CI: 96 to 99), and quitline calls and web hits fell by 65% (95% CI: 43 to 79) and 34% (95% CI: 11 to 50) respectively. The number of people setting a quit date and 4-week quitters at the SSS increased throughout the study period.

Conclusions

The suspension of tobacco control mass media campaigns in England in 2012 appeared to markedly reduce use of smoking cessation literature, quitline calls and hits on the national smoking cessation website, but did not affect attendance at the SSS. Within a comprehensive tobacco control programme, mass media campaigns can play an important role in maximizing quitting activity.

INTRODUCTION

There is substantial international evidence that tobacco control media campaigns increase quit attempts and reduce smoking prevalence (1-9); but such campaigns are often part of multi-component tobacco control programmes, and separating the effect of mass media campaigns from other tobacco control strategies is difficult. In England, from 1999 onwards, large scale tobacco control campaigns were run regularly as part of a comprehensive range of tobacco control policies. These campaigns used a range of mass media including television, radio and press, and often advertised free National Health Service (NHS) smoking cessation services, the national quitline, free quit support packs (most recently 'Quit Kits' (10)) and the national smoking cessation website. From April 2010, however, the government ceased spending on national public health mass media campaigns. A tobacco control mass media campaign was reintroduced in England in September 2011, but at a much lower rate of funding than prior to the cut. The suspension of tobacco control mass media campaigns provides a unique natural experiment to understand the importance of such campaigns within a comprehensive tobacco control programme. We conducted an interrupted time series analysis to estimate the association between the campaign freeze and a range of measures of quitting behaviour.

METHODS

Data

Our outcome measures were a range of indicators of smoking cessation activity. In England, intensive smoking cessation support is provided through NHS Stop Smoking Services (SSS) which offer counselling and access to smoking cessation medication. Non-intensive support can also be obtained via a national stop smoking helpline, quit support packs and the national smoking cessation website. We investigated the impact of the freeze on the use of both intensive and non-intensive support.

To investigate the association between the freeze and use of non-intensive smoking cessation support we used monthly population-level data on calls to the NHS quitline (April 2005 - September 2011), text requests for quit support packs (December 2007 - December 2010) and web hits on the smoking cessation website (January 2009 - March 2011, http://smokefree.nhs.uk/). These data were obtained from the Department of Health and cover different time periods due to variations in data availability.

To investigate the association between the freeze and the use of intensive smoking cessation support we used quarterly population-level data on the numbers of individuals setting a quit date and the total numbers of self-reported 4-week quitters at NHS SSS from Quarter 1 2001 to Quarter 3 2011. Smokers at the SSS are defined as 4-week quitters if, 4 weeks after their quit date, they report not having smoked – not even a single puff – in the past 2 weeks. This figure represents the absolute number of people making a successful quit attempt with the support of the stop smoking services. It was expected that if the number of quit dates set fell during the freeze, the number of successful quitters would also fall. These data were available from the NHS Information Centre (11).

Analysis

We used an interrupted time series design to quantify the effect of the freeze on our outcomes. We developed segmented regression models to test the hypothesis that there was a change in measures of quitting behaviour after the implementation of the freeze. Interrupted time series analyses estimate the effect of an intervention (in this case, the campaign freeze) on a time series of an outcome measurement. This type of analysis takes account of pre-existing and seasonal trends to isolate the effect of the intervention on the outcome. All our data were collected as count data, which are often analysed using Poisson regression; however, negative binomial models are more appropriate if there is evidence of high overdisperson (the variance is larger than the

mean) (12). Statistical tests showed that our outcome data were highly overdispersed, and we therefore used negative binomial regression models.

The response variables were the measures of quitting behaviour described above. The effect of the suspension of campaigns was defined as the percentage change in each of the outcomes after the freeze. This was assessed by including a binary predictor variable in the model with a value of 0 up to and including March 2010 and 1 in subsequent months.

The log of the estimated smoking population for England was included as an offset variable – a predictor variable with a regression coefficient fixed at 1. This ensures that there is a one to one relation between population size and the outcome variable. We used mid-year population estimates from the UK Office for National Statistics (ONS) to generate monthly and quarterly estimates of the population aged 16 and over, assuming that one-twelfth of each annual change occurred per month, or one-quarter of the annual change per three months (14). We used ONS projected population figures for 2012 as mid-year estimates were not available(15). We multiplied the monthly and quarterly population estimates by smoking prevalence estimates from the Health Survey for England in order to estimate the number of smokers aged 16+ in each time period (16).

Initial models contained the predictor for the freeze, a predictor for time and a seasonal term to account for seasonality. In the monthly models, month was fitted as a cyclic cubic regression spline to capture the seasonal pattern. In the quarterly models, quarter was fitted as a categorical variable. The effect of time was fitted as a smooth term using a thin plate spline initially, and the effective degrees of freedom (EDF), a measure of the degree of nonlinearity, were used to determine whether to retain time as a smooth term in the model or to fit a linear effect of time. Variation in month length (quarter length in the SSS data) was accounted for by including days in month (or days in quarter) as a predictor in the model. In addition, because there was a large peak in

some of the outcome measures in January 2010 (which was likely due to a particularly intensive media campaign in this period which offered free 'Quit Kits', boxes of practical tools and advice designed to offer support to those smokers who would not ordinarily access support from the NHS), a binary variable coded 1 in January 2010 and 0 in all other months was included in all initial models (in the monthly SSS models quarter 1 of 2010 was coded 1) (10).

Models were fitted in R using the gam and gamm functions from the mgcv library (17). We used backwards stepwise elimination of non-statistically significant terms ($p>0.05$) to build a parsimonious model. Predictors for the freeze and days in month (or quarter) were kept in all final models irrespective of statistical significance. Rate ratios allowing a comparison of the outcomes before and after the freeze were obtained by exponentiating the regression coefficient for the freeze predictor.

Autocorrelation functions were used to identify significant autocorrelation. Where autocorrelation was present, an autocorrelation error term was fitted to account for non-independence of model residuals.

We conducted sensitivity analyses to investigate the robustness of our models. Where the binary January 2010 variable was statistically significant in the final models, we re-ran the models without this term. We also re-ran all final models using our estimate of the total population aged 16 and over, as opposed to the smoking population, as the (log transformed) offset variable.

RESULTS

Figure 1 shows the number of quitline calls, literature requests and web hits each month during the study period. Quitline calls averaged nearly 20,000 per month before the freeze but with strong seasonal variation. Literature requests averaged 3800 before the freeze, with a large peak in January 2010. Web hits averaged just under 270,000 per

month prior to the freeze, with a slight downward trend through the study period. Figure 1 suggests that there were marked reductions after the freeze.

Figure 2 shows the number of people setting a quit date and 4 weeks quitters at the smoking cessation services for each quarter during the study period. It suggests that there was an increasing trend in numbers of people setting a quit date and successful quitters at smoking cessation services throughout the study period which did not change following the campaign freeze.

Table 1 contains the results of the regression analyses. It shows the regression coefficients and the percentage change in each outcome following the suspension of campaigns.

There was a statistically significant decrease in quitline calls, literature requests and web hits after the freeze. There was no statistically significant change in quit dates set or 4-week quitters at the SSS. The biggest decrease was in literature requests, which fell by 98% (95% CI: 96 to 99) after the freeze. There were also substantial decreases in quitline calls and web hits, which fell by 65% (95% CI: 43 to 79) and 34% (95% CI: 11 to 50) respectively.

The sensitivity analyses using the total population as an offset variable instead of the smoking population did not substantially change our results (Table 2). Similarly, when the binary variable for January 2010 was removed from the literature requests model the estimates did not change (Table 3). However, when this variable was removed from the quitline and web hits models, the decrease in these outcomes following the freeze increased to 76% (95% CI: -86 to -60) and 51% (95% CI: -71 to -19) respectively. The binary variable to account for January 2010 was not statistically significant in the SSS models and therefore this sensitivity analysis was not conducted for these models.

DISCUSSION

We found that the freeze on tobacco control campaigns in England was associated with a dramatic decrease in quitline calls, smokefree web hits and requests for cessation support packs, but that there was no change in the increasing trend in the use of NHS smoking cessation services during the study period.

A limitation of this study is that we were not able to look at the association between the freeze and population quit attempts and success. Only a small proportion of smokers use quitlines, websites, quit support packs and smoking cessation services, and our study therefore only captures a proportion of quitting behaviour. For example, only around 6% of quit attempts are made with the support of NHS services, the use of which is more common than that of the quitline or support packs (18). If the freeze reduced the rate of quit attempts as well as the success of quit attempts, its overall impact is likely to have been much greater. For example, mass media campaigns prior to the freeze may have caused unsupported quit attempts that are not captured by our outcome measures, or may have caused quit attempts in people using cessation support (such as the quitline) which would not have occurred in the absence of campaigns.

We found a clear association between the freeze and quitline calls and web hits but this effect may have been underestimated in our study. We used a dummy variable to take account of big peaks in our outcomes in January 2010 to avoid distorting the underlying pre-intervention trend. However, as there was a substantial peak in advertising in this month, it is most likely that the peak in the outcome was *due* to mass media campaigns. Sensitivity analysis showed that when this dummy variable was removed, the effect of the freeze on quitline calls and web hits was substantially higher.

A further weakness of our study is that limited data availability prevented us from looking at the effect of the re-introduction of mass media campaigns in November 2011. However, the simple interrupted time series design we have used has shown clear associations between the freeze and some of our outcomes.

A key strength of this study is the use of a wide range of measures of quitting behaviour measured at the population level over long time periods. The major strength of this study, however, is that it uses an interrupted time series design, which has enabled us to quantify the effect of the suspension of campaigns. Most previous studies of the effects of mass media campaigns have examined the effects of exposure varying over time, when numerous other interventions may be implemented and it has been difficult to fully take account of their effects (6). We have taken the opportunity of the freeze in campaigns to model the effect of complete suspension of campaigns using interrupted time series. This powerful quasi-experimental design is able to estimate intervention effects while taking into account underlying trends, thus ensuring that post-intervention changes are not merely continuations of longer-term trends. This method has recently been employed in the evaluation of a range of tobacco control policies (19-23). Whilst an interrupted time series analysis cannot disentangle the effects of multiple interventions that are introduced at the same time, we are unaware of any interventions being implemented around the time of the freeze that are likely to have substantially influenced our outcomes. The results of natural experiments should always be interpreted with caution, however, and replication of these results in different relevant outcomes and settings in the future would help to strengthen causal inference about the suspension of campaigns.(24)

While this is the first study to investigate a total suspension of tobacco control mass media campaigns, its results are in line with a substantial literature which demonstrates the impact of mass media campaigns on quitting and smoking behaviour internationally (1, 2, 4-6, 9).

Quantifying the implications of the reduction in literature requests and web hits is difficult, due to limited evidence of their effectiveness in increasing quit attempts and success. In the case of quit support packs, the monthly number of requests was low even prior to the freeze, with a mean of 3700 per month. Following the freeze there were fewer than 20 requests in most months. Prior to the freeze there were on average

approximately 20,000 quitline calls per month. Our analysis shows that this dropped by two thirds following the freeze. A recent study (which used the same source of quitline data as this study) demonstrated an effect of mass media campaigns on quitline calls in England but not prescriptions or sales of smoking cessation medication in England and Wales (8). It found that a 1% increase in advertising exposure led to a 0.08% increase in quitline calls in the same month; based on this estimate, the effect of the freeze on quitline calls seems bigger than expected. The effect of campaigns on the other outcomes considered in this study – SSS, web hits and text requests – has not previously been explored. Evidence indicates that between 16 and 24% of quitline-supported quit attempts are successful (measured at 6-12 months follow-up), compared with 3-5% of unsupported quit attempts (25-28). This suggests that a substantial number of successful quit attempts via the quitline may have been prevented as a result of the suspension of campaigns.

In contrast with the quitline, literature requests and web hits, we found no effect of the freeze on the number of people setting a quit date using the SSS. NHS smoking cessation appointments are often booked in advance, and it may be that people who try to quit as a result of mass media campaigns do so using less intensive methods prior to using intensive cessation services. We therefore re-ran the models to include quarters up to and including the first quarter of 2012 to check that the lack of effect was not due to a longer lag in the impact of the freeze on services. However, this did not change the results. The reasons for the lack of effect are not clear, but, unlike quitline and the NHS website which are mainly advertised nationally, services are extensively locally promoted; this enables services to manage the numbers of smokers driven to the service at any one point in time. This local advertising is likely to have continued during the freeze. In addition, our study only took account of the freeze on 'above the line' marketing, i.e. population-level mass media campaigns. During this period the Department of Health continued some more targeted 'below the line' national marketing activity through its database and low level paid-for search marketing [personal

communication], which may have helped to maintain the levels of use of SSS. It is also possible that campaigns have more of an effect on unplanned quit attempts, which may explain the lack of effect on the use of intensive support, which is more often used in planned quit attempts (29).

Overall, our results demonstrate that the freeze was associated with an immediate and sustained reduction in use of a number of sources of smoking cessation support, suggesting that mass media campaigns can have a very important influence on quitting activity. The national quitline, smoking cessation website and demand for quit support packs appear to be highly dependent on mass media campaigns which promote their use; our findings suggest that fewer people will use these sources of support if they are not consistently advertised. The findings from this natural experiment highlight the crucial role that such campaigns can play within a national comprehensive tobacco control programme. This study gives an indication of the magnitude of the effect of tobacco control mass media campaigns on quitting behaviour, but has not be able to capture the effect on overall quit attempts or success; this should be explored in future research. Future work should also explore the effectiveness of different types of campaigns and different calls to action, such as emotive hard hitting campaigns and those providing information about services, to ensure that the impact of future campaigns is maximised.

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Table 1. Results of negative binomial regression analysis to detect association between freeze on tobacco control campaigns and quitting behaviour

Final models*	Quitline calls	Literature requests	Web hits	Quit dates set	4 week quitters
Regression coefficient (95% CI)	-1.06 (-1.54 - -0.57) ***	-3.84 (-4.49 - -3.19) ***	-0.41 (-0.71 - -0.12) ***	-0.007 (-0.24 – 0.23)	-0.006 (-0.26 – 0.23)
Standard error	0.247	0.332	0.155	0.119	0.132
% change after freeze (95% CI)**	-65.32% (-78.65 - -43.45)	-97.86% (-98.88 - -95.88)	-33.97% (-50.02 - -11.31)	-0.75% (-21.36 – 25.86)	-0.58% (-23.26 – 28.40)
Other predictors kept in analysis					
Time (long term trend)	Yes	No	Yes	Yes	Yes
Month of year (cyclic cubic regression spline)	Yes	Yes	Yes	Yes (quarter, categorical)	Yes (quarter, categorical)
Dummy variable for Jan 2010	Yes	Yes	Yes	No	No
Residuals					
AR(1) model	No	No	No	Yes	Yes

*All models were adjusted for smoking population size and days in month (quitline calls, literature requests, web hits) or days in quarter (quit dates set and 4 week quitters).

**Calculated by exponentiating estimated regression coefficient for freeze predictor.

*** P<0.05

Table 2. Sensitivity analysis results– Adjusted for total population rather than population of smokers

Final models*	Quitline calls	Literature requests	Web hits	Quit dates set	4 week quitters
Regression coefficient (95% CI)	-1.06 (-1.58 - -0.53) ***	-3.93 (-4.70 - -3.29) ***	-0.44 (-0.744 - -0.14) ***	-0.002 (-0.23 – 0.22)	-0.001 (-0.25 – 0.25)
Standard error	0.243	0.330	0.155	0.114	0.127
% change after freeze (95% CI)**	-65.36% (-79.51 - -41.41)	-98.03% (-99.09 – 96.27)	-35.85% (-52.47 - -12.72)	-0.25% (-20.15 – 24.70)	-0.12% (-22.11 – 28.15)
Other predictors kept in analysis					
Time (long term trend)	Yes	No	Yes	Yes	Yes
Month/Quarter of year (cyclic cubic regression spline)	Yes	Yes	Yes	Yes (quarter, categorical)	Yes (quarter, categorical)
Dummy variable for Jan 2010	Yes	Yes	Yes	No	No
Residuals					
AR(1) model	No	No	No	Yes	Yes

*All models were adjusted for population size and days in month (quitline calls, literature requests, web hits) or days in quarter (quit dates set and 4 week quitters). The quitline calls, literature requests and web hits models were adjusted for January 2010.

**Calculated by exponentiating estimated regression coefficient for freeze predictor.

*** P<0.05

Table 3. Sensitivity analysis - January 2010 dummy variable not included in regression models

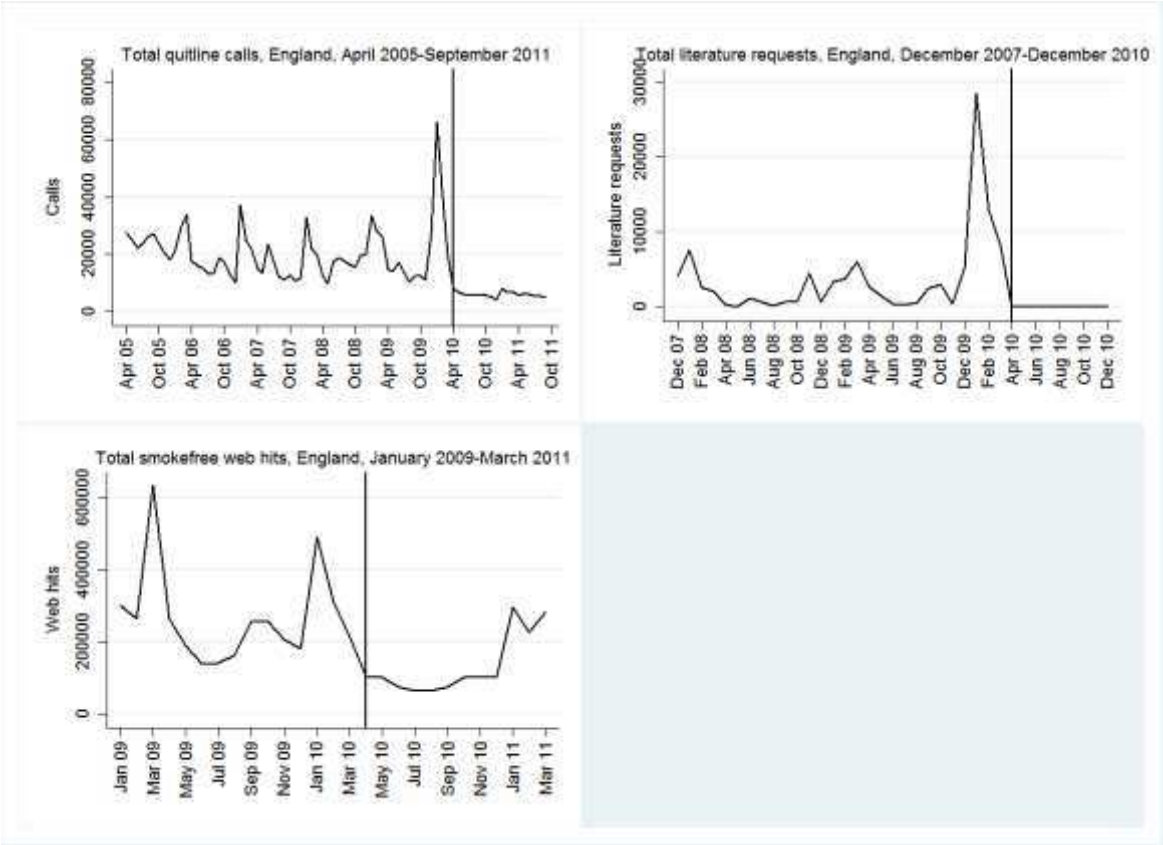
Final models*	Quitline calls	Literature requests	Web hits
Regression coefficient (95% CI)	-1.46 (-1.99 - -0.92) ***	-3.91 (-4.17 - -2.75) ***	-0.72 (-1.23 - -0.21) ***
Standard error	0.274	0.364	0.260
% change after freeze (95% CI)**	-76.78% (-86.33 – -60.14)	-97.99 (-98.45 - -93.61)	-51.32% (-70.77 - 18.94)
Other predictors kept in analysis			
Time (long term trend)	Yes	No	Yes
Month/Quarter of year (cyclic cubic regression spline)	Yes	Yes	Yes
Dummy variable for Jan 2010	No	No	No
Residuals			
AR(1) model	No	No	Yes

*All models were adjusted for population of smokers and days in month (quitline calls, literature requests, web hits) or days in quarter (quit dates set and 4 week quitters).

**Calculated by exponentiating estimated regression coefficient for freeze predictor.

*** P<0.05

Figure 1. Measures of non-intensive smoking cessation support, April 2005-September 2011



Note: graphs have different x-axis and y-axis scales. Post-freeze literature requests between 5 and 116 per month.

Figure 2. Quit dates set and 4 week quitters at smoking cessation services, Quarter 2 2001-Quarter 3 2011.